American Machinist

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Electric Locomotives—I

Fig. 1—New Pennsylvania streamline 4-6-6-4 electric locomotives are 79 ft. 6 in. long between couplings. They weigh 462,000 lb. and exert 4,620 hp. at 90 m.p.h. Total wheel base is 69 ft.; cab length, 76 ft. 8 in.

FRED H. COLVIN
Editor, American Machinist

BUILDING large electric locomotives, such as those for the Pennsylvania Railroad, involves many shop problems that are not found in the steam locomotive with which we are so familiar. There are few similar operations aside from pedestal jaws, couplings, wheels and axles, and brakes. And even the axles and wheels are different except for the tires. For the wheels carry spring-mounted driving gears and have a groove in the hub to provide a little elasticity to prevent axle breakage at this point, and the axles are ground not only for the seat of the inner roller race, but all over, except for the wheel fit.

These new locomotives are really two units under one superstructure. Each unit consists of a cast steel underframe that carries three driving axles and has a special four-wheel truck at the end. The two cast frames are connected with a ball joint similar to those used on Mallet locomotives. When coupled the locomotive becomes a 4-6-6-4 by the standard railroad designation, as seen in Fig. 1.

The frames for all the 57 locomotives were cast by the General Steel Castings Corporation, but the construction of the locomotives themselves has been divided among three plants, The Baldwin Locomotive Works, Pennsylvania Railroad shops at Juniata and the General Electric Company. The motor mounting and the wiring were done at Juniata except on the General Electric locomotives which were done at Erie. The details that follow are from the Baldwin Locomotive Works.

The cast steel frames for the three pairs of driving wheels also have an extension which reaches to the center bearing of the four-wheeled truck. This gives the wheels three pivotal points and makes the longest rigid wheelbase about 13 ft. The upper structure, or body, is pivoted at two points, one on each of the main frames, the points being about 45 ft. 11 in. apart. This method of support minimizes the side movement of the body while permitting a flexible wheel arrangement that is easy on the tracks

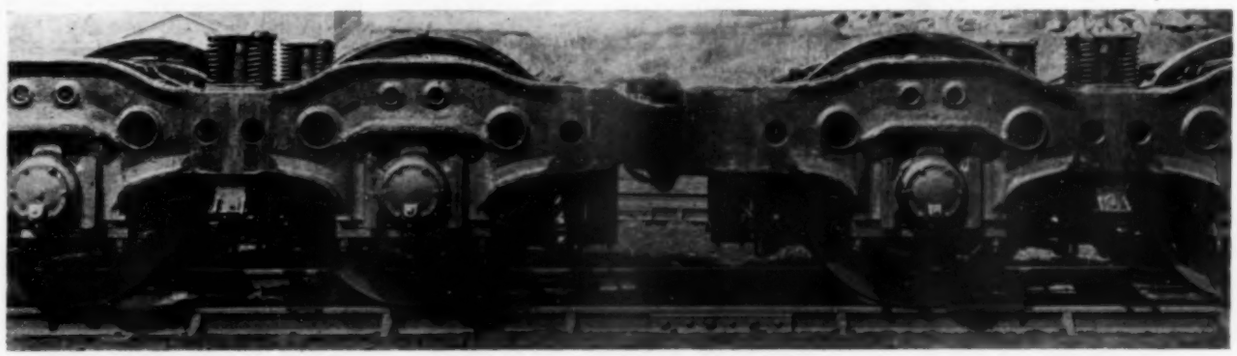


Fig. 2—Where the two main frames, each with six driving wheels, are coupled with a ball and socket joint. The side bearing plates are faced with manganese and supported by coil springs

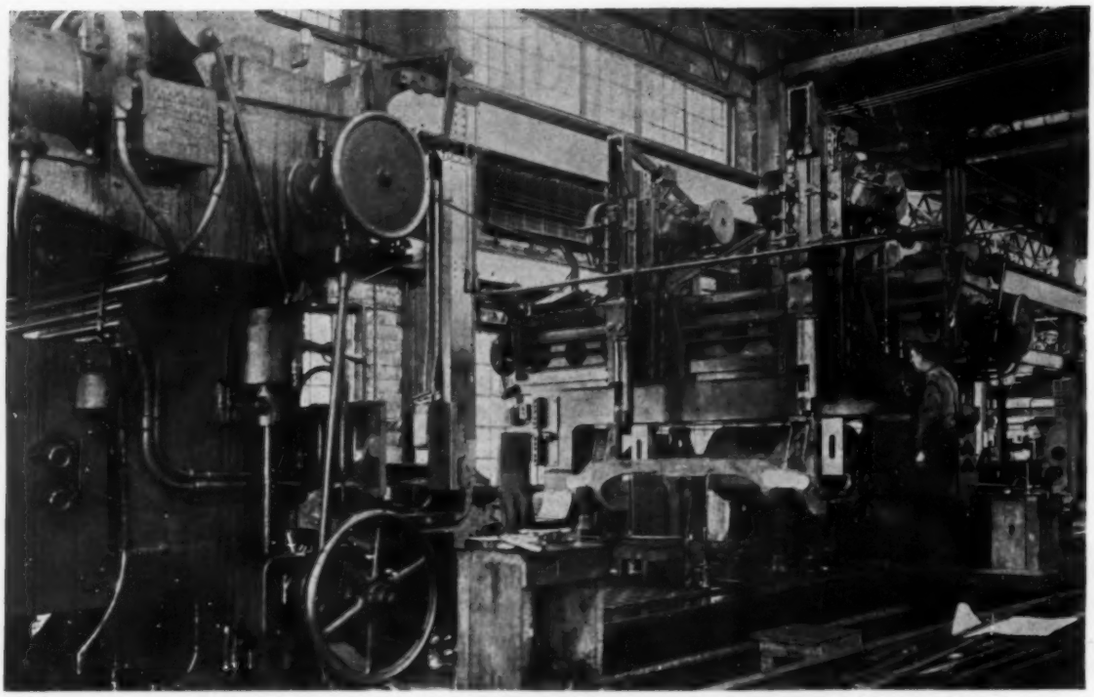


Fig. 3—Slotting the pedestal jaws on the truck frames on machines used for steam locomotives. These special slotters are very flexible so as to handle a large variety of sizes

when taking a curve at high speed. Spring mounted side bearing plates support the body and permit side movement. These can be seen in Fig. 2.

Machining on the cast driving wheel frames is largely confined to the pedestal jaws which locate the driving wheel bearing cages, and permit the vertical movement so necessary in railway work. In addition there is the machining of the truck pivot bearing on the underside in front, the bearing for the body bolster on top, and for the ball connecting joint between the two driving wheel frames.

Pedestal jaws of the truck frames were machined at Baldwin's by large special slotters as in Fig. 3, these being the same machines used in steam locomotive work. The frame jaws were milled by the General Steel Castings Corporation. The pivot bearings are machined on large floor boring machines and the bearing surfaces faced with cast manganese plates welded in position. The side bearing plates for the body are also faced with manganese plates. The connection between the two driving units is by a ball and socket joint, $10\frac{3}{8}$ in. in diameter, and with a 7-in. pin through the center. The machining of this ball is seen in Fig. 4, where the proper radius is secured by swinging the tool rest on a pivot set at a radius of $5\frac{3}{16}$ in.

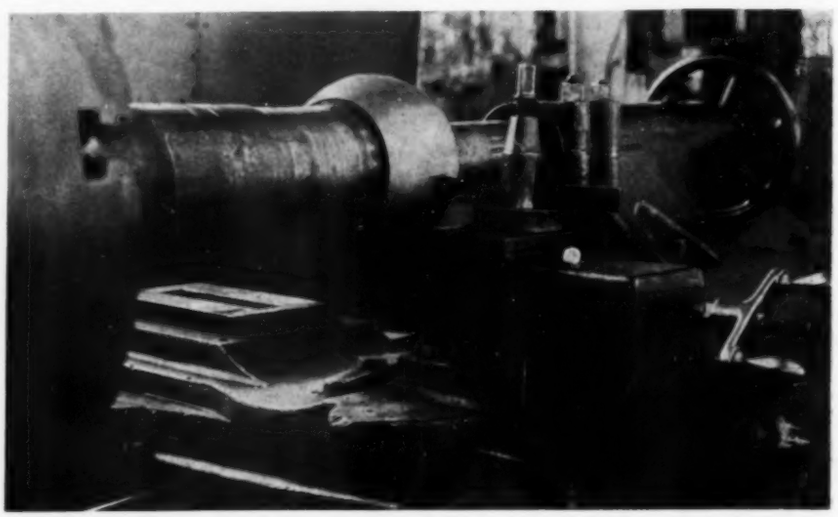


Fig. 4—Turning the ball used in the flexible connection between the two main driving frames. The ball is $10\frac{3}{8}$ in. in diameter and is mounted on a 7 in. pin. The tool swings at a radius of 5 3/16 in.

The driving wheels have 49 in. centers and are 57 in. outside diameter. The inner side of the hub is grooved, as mentioned. The spokes are faced parallel, near the rim, to receive the spring connection through which they are driven by the electric motors. These spring connections are attached to the quill which is mounted on large bearings on the motor frame. They support the ring gear into which the driving pinions of the motors mesh. This is shown in Fig. 2 as well.

There are two motors to each driving wheel. The springs cushion the driving effort in starting. The spring seats have hardened wear plates. Another difference from steam locomotive practice, in this country at least, is the grinding of the driving axles for the press fit of the inner race for the roller bearings. New grinding machines were installed for this work.

The frame of the upper works may be said to consist of two parts, the

Fig. 5—Special drilling machine for long work. Used here to drill rivet holes in the long center sills that form the bottom of the truss for the cab and its frame work. Each short arm radial is movable on the main frame or rail

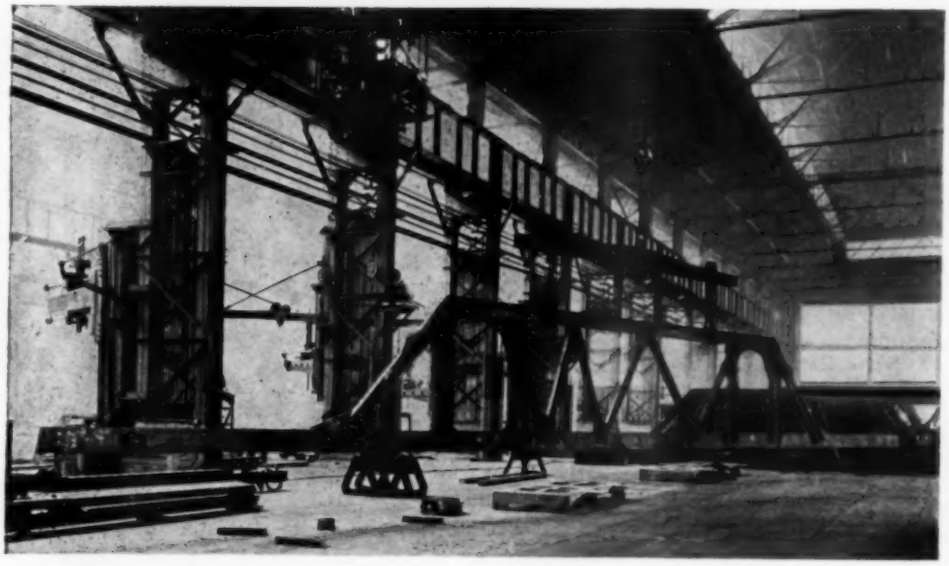


Fig. 6 — One of the trusses being moved from the riveting stand to be assembled on the cross members. These form the frame work for the cab and are 76 ft. 8 in. in length. The top of cab is 14 ft. 1 in. from the rail

inner or truss member, and the outer framework which carries the outer walls or sheathing. The two trusses that form the inner body resemble a modern bridge and rest on heavy cross members at proper intervals. The channels that form the bottom chord, as well as the other members that require drilling, are drilled on the multiple head radial machine seen in Fig. 5. These were built especially for locomotive work, each has a short, rigid arm, the spindle being belt driven from an independent motor. These machines handle a great variety of work.

These trusses are built up from suitable shapes and plates cut to shape, numbered and placed near the assembling stand so as to be easily reached. Both rivets and welding are used in fabricating these trusses. The size of the job, and the care necessary in assembling can be seen from the illustrations.

The first step is to place the numbered parts in their proper position on the first assembling stand which shows the location of each piece. After being placed they are tack welded and bolted until the asembly is ready to weld and rivet into a complete whole. When a side truss is completed, it is lifted from the platform by cranes, as in Fig. 6, and carried to the assembling stand a few feet away.

The assembling stand, shown in Fig. 7, consists of heavy beams mounted on concrete and properly leveled. The two side trusses that make up the inner structure which is virtually a trussed bridge are spaced properly on the cross beams that connect them, aligned with a steel wire in approved fashion, and the various members welded into position. Steel plates are fastened across both top and bottom of the floor

Fig. 7—Cab frame trusses mounted on the cast steel cross members. This shows the construction of the stands on which these cabs are erected. The stands are of wide flange I-beams mounted on concrete

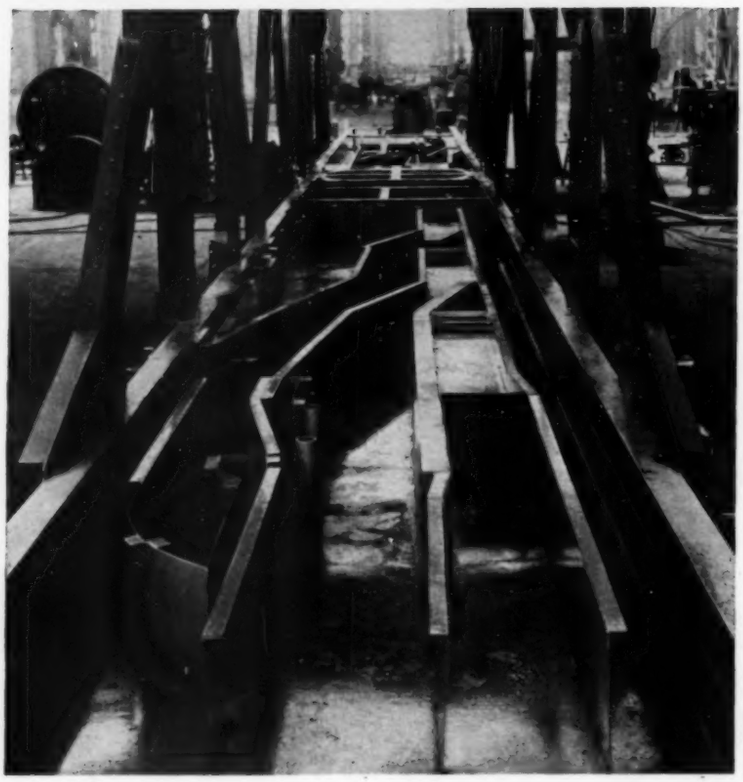


Fig. 8—Between the lower deck and the floor of the cab is a series of conduits to conduct air from the blowers to the motors. Maximum power of the motors at high speed depends on keeping them cool

beams to form air ducts from the blower to the motors, as seen in Fig. 8. These ducts are cleverly arranged to serve the double purpose of directing the cooling air where it is needed and to act also as supports for the upper plate. Bases for the oil-fired heating boiler and other apparatus are fastened in at various places. The two bearings for the pivotal points of the upper works on the articulated truck are also fastened in place.

Floor plates are sheared, torch cut to shape where necessary and the edges milled in gangs to present smooth edges. This is also true of the gusset plates. Edges of the large floor plates are finished by planing. Templets are used to a great extent in laying out sheets, gussets and other parts. They are drilled in line or gang drilled.

There is so much apparatus to go in these electric locomotives that the interior above deck reminds one of a torpedo boat or a submarine. There are, for example, twelve tanks for water and fuel oil in addition to eight sand boxes to be stowed away between the truss members where they will not take room needed for other apparatus and the numerous controls. These tanks are made of such shapes as will fit around struts and into corners not otherwise occupied.

Roller bearings are used throughout the locomotives, both Timken and SKF being employed. The inner race is pressed on a ground fit on the axle and the bearing assembled in the special boxes which provide vertical movement as in steam locomotive practice.

Some of the interesting dimensions of these locomotives are:

Rigid wheelbase of each unit 13 ft. 8 in.; total driving wheelbase 37 ft. 4 in.; total wheelbase 69 ft.; distance between truck centers 61 ft.; length between couplings 79 ft. 6 in.; width overall 10 ft. 5½ in.; height, top of rail to top of cab, 14 ft. 1 in.; length of cab 76 ft., 8 in.; total weight 460,000 lb.; horsepower at 90 m.p.h. 4,620.

Cab construction is unusual in having large hatch openings and covers in the roof. These are large enough to permit heavy units, such as the generator, blowers and other accessory equipment, to be lifted out. Ladders on the cab interior give the engine man access to the roof at any time. Another novel feature is the placing of the electric headlights in the end doors of the cab.

Machine Safety—Who is Responsible?

A condition of divided responsibility exists with respect to safety in machine tools. Both maker and user should consider the many factors discussed

THE BURDEN of insuring that the operation of the machine tool is acceptably safe to the operating personnel is the responsibility of the purchaser. Fundamentally, the equipment maker bases the value of his machine to the purchaser upon the output of acceptable work for a given operating expenditure in comparison with some competing machine. It is unlikely that equipment builders can initiate extensive improvement with regard to safety unless the equipment engineer demands them. Moreover, a fundamentally safe machine, because of the manner of installation or tooling, may become unsafe unless the equipment engineer exercises continuous supervision.

The Buyer's Attitude

In the viewpoint of the purchaser, however, there are certain factors which are the responsibility of the machine builder. Exposed and moving parts of the machine which can catch the person or clothing of the operator should have guards built in, not stuck on. They should allow quick accessibility to machine parts, and might well be provided with locks to be released only by authorized supervisors. Tricky controls are often located so that operators have to run around the machines to get at them. This type of machine will eventually cause an accident. The probabilities are that the cost of the accident will far more than pay for extra expense involved in designing simple and properly located controls. Such controls should function naturally. If a part is to move to the right the control handle should move to the right. Guards or recesses should be provided for the control handles or buttons when they might be accidently struck during tool adjustment.

Controls for hydraulic power or compressed air are not usually sufficiently positive to insure proper safety. Worn packing or valve seats permit unexpected motion of machine parts. Yet, it is a simple matter to design controls so that pressure leakage may be bypassed so as not to urge the machine parts. A simple method is the use of two shut-off valves in tandem, with an intercepting exhaust valve between them, or the equivalent structure built into one valve. In hydraulic systems, the design often does not provide for bleeding air trapped in the fluid lines. On starting up such a system the action of compressing the trapped air often causes an unexpected jump in the machine parts. Small bleeder pipes tapped into the highest parts of the system will overcome these difficulties.

Most equipment nowadays makes use of electrical units operating on 440-volts. Such voltage is an ever present danger. Nevertheless, an inspection of almost any shop will reveal some instances of "temporary" wiring, taped up and lead over surfaces which may chafe insulation or be so located that the personnel will get tangled up in the wiring. Even 110-volt circuits are not to be played with. The machine tool builder can do much towards building in much of the wiring and providing proper lighting circuits.

Comfort of Operators

Generally speaking, machines are not designed in a satisfactory manner from the standpoint of retaining or disposing of spray, dust, fluid drip or leakage, and fumes. If any of us had to endure for five minutes, at home or in a public place, the conditions that many operators have to face for eight hours a day, something drastic would be done about it. Men and women stand or sit at machines which cover them with dirty water, oil and dust, or they breathe in smoke and dust, where a little careful designing would reduce their discomfort. Much can be done without excessive cost.

With modern tungsten carbide and similar tools permitting higher work speeds, red-hot crumbs of metal are often violently thrown from the cutting zone, but I doubt whether this fact has been given serious consideration in the redesign of machines to take advantage of the new tools. The principal hazard is eye injury, but even with goggles a man is not going to face a barrage of hot particles and still do a safe and efficient job.

Many automatics are designed to get tools to and from the work with the least possible movement. This makes for a very congested layout at best. There is usually not room for proper chip clearance, and chips are packed into undesirable locations and projected outside of the machine itself unless very extensive shields or guards are used. On brittle materials having short crumbly chips, this is not serious, but in machining tough stringy materials it is a constant source of trouble and tempts the operator to take chances. Perhaps it would cost slightly more to provide a design allowing more room for indexing, but even that is doubtful.

Many machines come equipped with certain tools such as chucks, steadyrests, sizing devices, hoists and other work-handling devices. Where heavy pieces must be handled in and out of the machines, real care must be exercised in the design of these accessories. It is not uncommon to find cases where the machine builder apparently expected an operator to juggle pieces weighing from 50 to 150 lb. or more while standing in an awkward position.

The Buyer's Responsibility

So far the obvious responsibilities of the machine builder have been discussed, but the final responsibility is that of the user. It is difficult to eliminate the user's tooling layout from consideration and to discuss only machine features. The responsibility is primarily up to the equipment engineer, but in most organizations there is a situation of divided responsibility which finally winds up with the foreman of the department in which the machine is installed. It is obvious that the equipment man should give him assistance and follow the job through preliminary operating trials to be sure that all safety items are covered and functioning properly.

An abstract of a paper by W. H. Chapman, supervisor of the methods and equipment division, the Hyatt Roller Bearing Company, presented before the Newark Safety Council.

Cutters for Milling Helicoids

ROLAND V. HUTCHINSON

PROFESSOR Earle Buckingham showed, in Progress Report No. 3 of the A.S.M.E. Special Research Committee on Worm Gears, how the shape of a milled helicoid changes with change in diameter of conical generating cutters or grinding wheels. The present treatment outlines one method of determination of meridian sections of milling cutters or of grinding wheels to produce helicoids of pre-assigned shapes.

Conditions determining a helicoid are its lead and the shape and position of the generatrix with respect to its axis. A transverse section of a helicoid ensues from screwing the generatrix through a plane normal to the axis, the section curve being the locus of penetration.

Expressions for coordinates for any such intersection point yield the equation of the transverse section. This, in conjunction with the lead, equally specifies the helicoid.

Thus a helicoid may be considered as built up of a series of coaxial helices, whose elemental cylinders are of radii ρ, whose phasing with respect to some reference or direction is θ, and the form of the equation of the transverse section is $\rho = f(\theta)$.

Further, consider the cutter or grinding wheel composed of a series of concentric circular laminas, so that a contact point between cutter and helicoid surfaces must perforce lie simultaneously on an elemental lamina, an elemental helix and an elemental cylinder.

Moreover, at contact the cutter and the helicoid must have x common surface normals, and through any point of contact such surface normal must pass through the cutter axis.

It, therefore, becomes possible to obtain the radius of an elemental cutter lamina by projecting into a plane normal to the cutter axis the appropriate elemental helix and discovering the radius of the circle concentric with the cutter axis which just touches this helix projection.

Referring to the illustration, the right hand view shows a normal section of the pre-assigned helicoid, containing a point P whose coordinates are ρ, θ. The cutter axis is offset D from the work axis. The point O at the same radius has been arbitrarily chosen as a point of reference.

Projecting over to the left-hand view, we have the projections of cutter and work axes, and the XX plane all intersecting in O, and the point P in XX lies on the helix which in this view is the sine curve $SPKf$, of amplitude ρ and period equal to the lead L of the worm. Cutter and work axes here include the acute angle λ.

The diagonally projected view shows the elemental helix reprojected into a plane normal to the cutter axis, and in such plane this axis projects as a point.

The radius of the osculating circle is then R_K, tangent to the helix projection at K in this view.

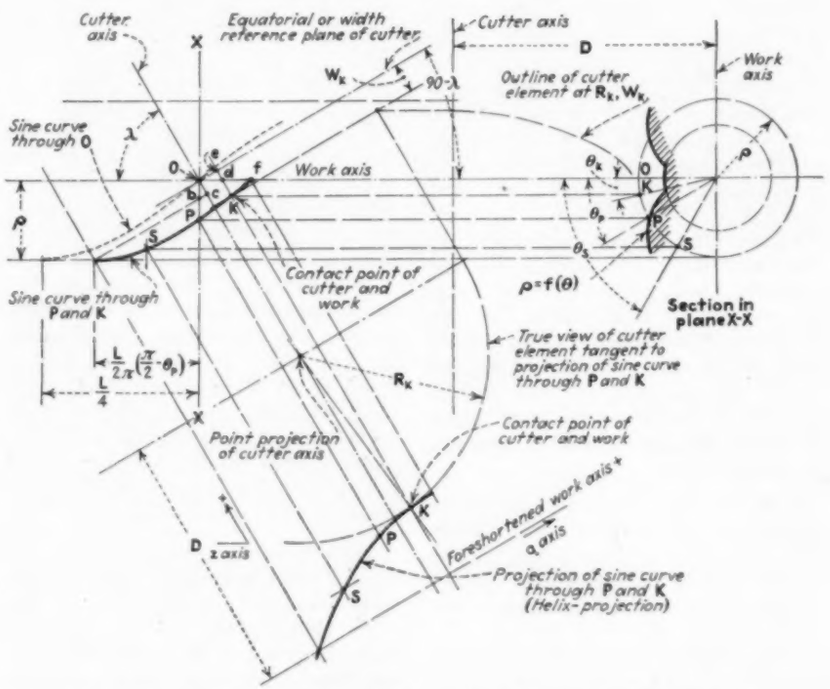
Through K draw a line parallel to the cutter axis toward the left-hand view. This parallel intersects the sine curve $SPKf$ in K between P and f, locating K definitely. K is distant from the equatorial or reference plane of the cutter length Ke measured axially of the cutter, hence the coordinates of the point on the meridian section of the cutter which generates the helix of radius ρ on the helicoid, are R_K, W_K.

Repetition of this typical construction yields point by point suitable coordinates of the cutter meridian to produce the desired helicoid when λ and D are repeated physically in the shop.

For grooving taps, cutters, drills and the like this graphical method suffices. For accurate worm grinding further development is advisable.

It is perfectly obvious by inspection of the sketch that if D be increased, R_K increases and the osculation point K in the oblique view moves uphill and toward the right. But K must stay on the elemental helix and approaches f in the left view; consequently, if D and likewise R_K increase, W_K must correspondingly diminish.

Therefore, if one wishes to perpetuate the shape of a given helicoid produced over a large range of D variation the meridian section of the cutter or wheel must systematically vary while λ remains constant.


Cutter axis
Equatorial or width reference plane of cutter
Cutter axis
D
Work axis
Outline of cutter element at R_K, W_K
Sine curve through O
Work axis
Contact point of cutter and work
$\rho = f(\theta)$
Section in plane X-X
Sine curve through P and K
True view of cutter element tangent to projection of sine curve through P and K
Point projection of cutter axis
Contact point of cutter and work
Foreshortened work axis
Projection of sine curve through P and K (Helix-projection)

Calculation of points on meridian section of screw milling cutters

The shortcomings of the graphical method arise because *SPKf* in both left and diagonal views is not directly generable on the drawing board, errors of manipulation may be cumulative, and accurate establishment of W_K depends upon the difficult feat of accurately locating the point of osculation *K*.

Coordinates of points on the meridian section are obtainable in the following manner: Determine the equation of the helix projection in the diagonal view, differentiate for slope and to get the normal equation through the point center of the cutter lamina. Out of these may be obtained coordinates of *K*, and hence the value R_K. The value of W_K follows easily from consideration of the left-hand and the transverse views. The requisite mathematics are not unduly difficult.

Repetition yields sufficient points to establish the general shape of the required meridian section.

Next, to apply the method to the use of one templet to approximate the demands of a fairly wide variation of grinding wheel size and of corresponding offset *D*. For the same ρ, θ values of the helicoid, $R_K W_K$ values are computed for various values of *D*. Assuming three *D* values and at least five corresponding pairs of $R_K W_K$ values computed, the corresponding meridian sections may be laid in with the aid of either logarithmic spiral templets or by the Maclaurin five-point quartic construction.

By translation and tilt, any one of the thus established meridians may be caused to lie on the other two in pairs of points and resulting discrepancies examined.

Use With Different *D* Values

Such translations and tilts are representative of necessary changes in location of a given dresser control templet to permit its use for more than one *D* value *i.e.*, over a range of grinding wheel diameters.

Specific applications obviously depend upon grinder details.

One other instance occurs which requires a slight change in technique. The foregoing applies strictly to thread grinders or thread millers in which, as the head is tilted to different angles, the axis of the cutter spindle sweeps out a *plane* parallel to the work axis.

Some Pfauter thread millers do not meet this specification. The axis about which the head tilts is, as usual in other machines, normal to the work axis, but as it tilts the cutter axis sweeps out a cone whose opposite slant sides include an angle of 160 deg. This is done to provide a more robust cutter drive. Consequently to produce a symmetrical helicoidal groove an unsymmetrical cutter must eventuate.

After the head has been set over to the angle λ as above, in the graphical layout, the section normal to the cutter axis is still the one into which the elemental helices must be projected, but it needs two successive projections of the sinusoidal *SPKf* in the left view.

The analysis will take cognizance of this "conicity" feature by the introduction of some sin 80 deg. or cos 10 deg. terms as multipliers, but at this time it is not thought necessary to enlarge upon the subject.

Employment Problems in a Small Shop

A. W. FORBES
Forbes & Myers

There is a common but mistaken idea that employers are besieged by applicants for work, and that all they have to do to get more men is to make a selection from a long list of applicants. To test this belief, we decided to make a list of all applicants for work during the month of July. This month was selected because it followed the closing of schools, when so many graduates would be seeking their first jobs. In this particular July there were also many men laid off from other plants on account of a reduction in orders.

As expected, there were more applicants that month than usual, but the number was incredibly small. The following list includes every applicant who applied in person at the office:

Two foreigners—they could not be interviewed on account of lack of a common language.
One trade-school student for summer work.
One trade-school graduate having a few years' experience in an overcongested trade.
One technical-college graduate in electrical engineering, class of 1934.
One building-trades mechanic, incapacitated for his trade by age and failing health.

SUMMARY

Total positions to be filled	0
Total applicants of all kinds during the month	6
Experienced applicants who might be hired as skilled men	0
Unskilled applicants whose names were taken as possible future employees	1
Number now on waiting list in case more workers are needed	1

It might be thought that workers knew we would not need any more men in this month. If so, they knew more than the management, for there were several orders under consideration that if placed would have made it necessary to hire additional employees.

Some may think that our location is obscure, but such is not the case. Our location is in the center of a city of about 200,000 population. We are almost next door to the fire headquarters on one side and the main police station on the other, and at almost the center of a triangle formed by the city hall, the city auditorium and the railroad station. While the street is not a main thoroughfare it is the most important factory street close to the commercial center. We are well located on the second floor of a well-known real estate development providing floor space, power and service to manufacturing tenants.

There is nothing exceptional in the list of applicants given above. I think it is a fair example of the experience of small plants all over the country.

Ethics in Tolerances Discussion

M. P. DALTON
Sevenoaks, Kent, England

If we stretch the meaning of the word tolerance somewhat, there are some interesting points in buying besides those mentioned by Robert S. Alexander (*AM*—Vol. 79, page 19).

The directors of many of our factories have no knowledge of modern shop management but are experienced merchants. A merchant owes his success largely to the gift of bargaining.

Such a concern bought a small machine in quantity. The machine was a good one, and its price was below that of any other machine of its kind in the country. The merchant-owner was not satisfied with the price and bargained until he got a very low price indeed, so low that he would not even discuss purchasing elsewhere. Deliveries were always in arrears. Alterations, corrections and special requirements were delayed until many times the saving in price was lost. The reason was that the price had been cut until the maker could give no service without loss. Any manufacturer of experience would have willingly paid more for the machines and would not have suffered all schedules to be ruined by late deliveries and the lack of important service.

Straight-line production on the new style plated evaporator was made possible by using some of the presses from the punch shop and purchasing others

Decentralization in a Punch Shop

EDWARD A. NECKER

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Westinghouse Electric & Manufacturing Company

OUR PUNCH shop, housing in its annex the plating section and the polishing section, was similar to Topsy who "just growed." The problem of floor space was contrary to the times. While many manufacturers were wondering what to do with excess floor space, our problem was where to find more of it. The natural feeling existed that extra expense during a depression was not warranted. A survey of possible savings showed that there would be a saving in handling costs, due to a concentration of operations, and a tying in of some of these operations on conveyors already installed. Another saving would be possible by purchasing some of the latest machines and equipment that would perform the operations quicker and better.

The importance of this decentralization was increased by the introduction of new products and designs in our miscellaneous household appliances, requiring new methods of manufacture. The first phase of this decentralization came about when the refrigerator unit was manufactured. The load increased to such an extent that the area allocated to the making of copper tubes in the punch shop was no longer adequate. The problem of space and equipment was solved by moving the entire job to the building where the refrigerator unit is manufactured. Here new machines were added with a considerable saving in time. Another advantage was more direct supervision under the refrigerator department and near the assembly line.

Next was the change in design of the refrigerator evaporator from porcelain to a plated all-metal evaporator. The floor space required for the fabricating of this product required a new layout in another department for spot and roller welding, presses and plating apparatus. As the press operations were to be performed after the spot and roller welding and before the plating process, the necessary presses were removed from the punch shop and included in the new department. This permitted straight line production within the department, reducing the handling of material to a minimum. In addition to the equipment transferred from the punch shop one large new press was purchased and installed to bend the evaporator into a U shape.

Another phase of decentralization followed a change in the design and finish on the vacuum cleaner, requiring polished die castings. A survey of our polishing equipment showed that it was not suitable for the kind of heavy polishing required, and in addition, the contemplated load could not be accommodated in the overcrowded polishing room. In order to find a location, the department machining and assembling the vacuum cleaners was surveyed. When some obsolete equipment in the department was removed, the space was found adequate and tied in with the chain conveyor already installed to carry the machined parts to the assembly section.

The new polishing room was laid out with a new type of heavy polishing jacks with individual drives and a modern blower system. The automatic polishing machines that are used on the electric fan parts were transferred from the old polishing room to the new one. This accomplished two purposes: first, to bring the polishing closer to the assembly point; and, second, to provide additional space in the old polishing room.

As soon as the new polishing room was completed, the old polishing room was completely renovated. The polishing jacks were relocated to provide more space between them due to the increased size of the new parts to be polished. The buffing jacks were separated from the polishing jacks, and a more efficient blower system was installed. Old material racks were replaced with modern skids, and new wheel racks were added.

With the increased number of parts requiring bright finish, we turned to burnishing. New burnishing equipment was purchased and installed in a bay that had been cleared out so that all burnishing could be done in one section. The old burnishing equipment was moved from the old polishing room to the new section. This last move of equipment from the old polishing room completed the renovation.

The management had previously divorced that part of the plant manufacturing small motors from the rest of the plant manufacturing miscellaneous household appliances. The punch shop was, of course, a feeder section for both. A survey of the remaining equipment in the punch shop showed numerous machines that were used entirely for making small motor parts. The presses and machines used for making name plates were equally divided between the small motor section and the appliance section. The machines used for making such small motor parts as resistance rings, conductors and indexing machines were all moved out of the punch shop to the small motor section.

Other machines were found to be used continuously on parts made for the appliance section, such as, refrigerator fan rotors and stators that have a high activity. These machines were also moved out of the punch shop to the appliance section.

During heavy buying periods such spaces as had been vacated by presses and machines were filled with the overflow of raw material from the storeroom area. This condition was first relieved by an addition to the punch shop to be used for the storing of raw material only. However, the condition was finally corrected when a new Ditto system was installed requiring that a definite space be allocated to a storeroom from which all raw material would be issued. In order to accomplish this, a battery of nine presses was moved out of the area reserved for a storeroom. Some obsolete machinery was disposed of. The purchase of a new baling press for baling scrap made it possible to locate it in a midway position between the two largest sources of scrap. This reduced the hauling distance considerably and permitted a more efficient disposal of the bales into the railroad cars. The area left by the old press provided storage space.

Decentralization has answered our immediate problem of floor space and resulted in savings by reducing material handling costs.

The new polishing room combines convenience of arrangement and up-to-date equipment

A new burnishing department with new barrels exemplifies the substitution of modern methods for old

Can the Railroads Justify Modern Machine Tools?

ALEXANDER SELLERS, JR.
William Sellers & Company, Inc.

Top railroad executives now find that locomotive and rolling stock repairs are the major item of expense. Will they adopt the author's suggestion for an advisory group to cooperate in raising the backshop to the efficiency of a manufacturing shop?

THE RAILROADS are now entering a period of increasing traffic and are doing so in a greatly devitalized condition. During the depression operating revenue decreased sharply, thus necessitating drastic decrease in maintenance expenditures. In addition, the railroads were harried by uncontrolled and subsidized competition, high wages, high fixed charges, and government regulations. Now as an increasing demand for railroad transportation becomes evident, additional difficulties are presented in the form of still higher wages, additional government regulation, and threatened government ownership, notwithstanding the results of government ownership here and abroad.

With these difficulties confronting the railroad executives of this country, it is small wonder that they have not been able to devote more time, thought, and energy to the question of maintenance and equipment.

The condition of the rolling stock is well known to railroad men and they are fully aware of the deferred maintenance that must, sooner or later, be taken care of on this equipment. Unfortunately, however, the condition of the shop equipment is not so well known to railroad executives in spite of the fact that they must rely upon that equipment to put and maintain their rolling stock in serviceable condition.

As transportation is a railroad executive's major problem and rolling stock is a primary essential to transportation it is not surprising that shop equipment, which is of secondary importance, should apparently be subordinated in these trying days. Furthermore, railroad executives are not, generally speaking, production minded either by training or vocation any more than the executive of a production manufacturing plant could be considered transportation-minded either by training or vocation. It is not surprising, therefore, that the railroad executive does not look upon the condition of his shop equipment with the same significance that an industrial executive views the machines on which the efficient production of his product depends. But that does not alter the fact that the railroad shop equipment needs executive attention and that it needs that attention now, if for no other reason than that a survey by *American Machinist* has shown 71 per cent of their machine tools to be more than ten years old.

Of course, railroad executives do know they need better machine tools in their maintenance shops, but they do not know how badly they need that equipment, nor can the shop executives present sufficient factual information on real cost of producing work on certain equipment, or the losses sustained through inaccurate output on that equipment, to prove conclusively that it would be financially advantageous for the railroad to appropriate funds for the purchase of machine tools, even though the railroad is not operating at a net profit.

Unfortunately, many look upon the railroad shops as a necessary evil rather than as manufacturing departments that could and should be operated as profitable units of the parent organization—the railroad companies.

Railroad shops certainly cannot be compared to modern and efficient manufacturing plants. Even the executive point of view is different. Manufacturing plants are operated, from the top executive down, on a plan conceived at and directed from the head of the organization.

The railroad shop might be considered as working in the opposite direction, that is from the bottom up, and without a plan. They are confronted with one major problem—having rolling stock available to move any amount of merchandise to any place at any time. That is transportation and, as a problem, contains so many variable conditions that the shop personnel devotes its time, thought, and energy to having enough rolling stock available to meet transportation requirement. These men have been born and brought up in industry that until recent years was a virtual monopoly, wherein to them cost was not a first consideration. They are transportation-minded by heritage and training and do not, therefore, look upon their maintenance problems from the cost point of view, as does the production manufacturing plant.

It is true, of course, that many railroads have given serious and sound consideration to maintenance problems and as a result have abandoned isolated shops, combined and consolidated others, and transferred and rearranged equipment in order to institute manufacturing methods. Unquestionably, these steps are in the right direction and will gain momentum with time and experience.

There are, of course, staunch advocates of the engine-house method of maintaining locomotives, who can no doubt, under prevailing conditions, justify their beliefs. But as more is learned about actual costs, by virtue of sound costing methods, and as better equipment and more experience with production methods bring about the inevitable improvement of the maintenance work performed in the back shops, the result will be the eventual elimination of the engine

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Presented under the title "How Can Railroad Shops Justify the Use of Modern Machine Tools and Methods" before the Railroad Division of the American Society of Mechanical Engineers at the semi-annual meeting in Cincinnati, June 19.

house for repair work, leaving it responsible only for storage, lubrication, and minor adjustments. We, therefore, have to look upon the development and expansion of production methods in strategically located shops as the key to lower maintenance costs, whether they refer to locomotives, cars, or other equipment.

Generally speaking, the machine-tool industry recognizes the serious plight in which the railroads find themselves and has endeavored to point out the economic advantages that can accrue from the installation of modern equipment and methods. Unfortunately, the buying personnel of the railroads has not been able to consider the plans advanced by the machine-tool representatives with the degree of interest or understanding that these plans deserve. Consequently, those tools which have been purchased in recent years have, of necessity, been bought to replace specific machines on a specific class of work, without regard to the relation that exists between that tool and work and other somewhat similar tools and work.

Emergency Purchases

We know the railroads would like to have considered the adaptability of a new tool to other work, but, when a tool is being considered, they invariably do not have sufficient time to go beyond the immediate problem confronting them. These new tools, certainly, in the majority of cases, have been bought as emergency measures rather than as the result of anticipated needs based on careful analysis and study made in conjunction with the manufacturers of such equipment. That, however, does not mean that equipment purchases have not been wisely made. Far from it! The new tools unquestionably would, if adequate cost records were maintained, show that the railroad is earning a substantial return on the investment. Any new tool that will show a profit will, of course, play its part in improving the railroad situation. There is plenty of room for new machines.

However, if the railroads would carefully analyze their repair problems, and, as a result of that analysis, establish a flexible but nevertheless specific plan built upon production methods and then, as opportunity presented, replace their old and obsolete equipment with new machines of either standard or special design to fit into their production plan, they would benefit not only from lower maintenance cost but from better and therefore more efficient repairs to individual parts, and to assemblies in which the individual parts have been repaired in several departments.

To carry out the necessary analysis on which to establish a production plan is of course a difficult but not impossible job. Naturally, it is unnecessary to impress management with the high cost of maintenance, particularly locomotive repairs, which for the period from 1925 to 1929 inclusive averaged $433,000,000 annually, and constituted the largest individual railroad expense.

Cost Breakdown

The railroad executives know how that tremendous item is broken down into direct and indirect labor, material, and overhead for the erecting, machine, boiler, pipe, and other shops, but, generally speaking, that is as far as they could go on a break-down of their control figures. Railroad accounting does not break down or segregate costs in sufficient detail to permit the distribution of the true cost of doing a given job on a given machine, nor have railroads amortized their shop equipment along the lines followed by successful industrial concerns.

In a well-managed manufacturing plant, and we must sooner or later look upon back shops as manufacturing plants, it is absolutely essential to know the cost per hour of operating any machine tool in order that the relative efficiency of each individual tool can be known. Without such information, methods pertaining to individual tools, groups of tools, individual departments, or groups of departments cannot be modified or correlated to obtain maximum efficiency.

In determining the operating cost of any machine, manufacturing plants, take into consideration average life, obsolescence factor, replacement value, interest, depreciation, repairs, hours operated per year, power cost, and overhead cost of the area occupied. Overhead is based on the cost per square foot per year as determined by land value, building value, building depreciation, insurance, repairs, interest and taxes on land and buildings, heat, light, and water.

To recommend the adoption of an industrial cost system for the railroad shops would, at this time, be unwise because the railroad executives are already confronted with so many critical conditions that the presentation of any plan, good or bad, which advocated a change in their present accounting methods would be doomed to failure. That does not alter the fact that the railroads must, sooner or later, establish some yard-stick for measuring the true efficiency of maintenance, men, methods, and machines. Such a step is essential and to say that they cannot or will not institute such a measure is to ignore the spirit, aggressiveness, and ingenuity of those men who compose the great American railroad fraternity.

Such steps have been taken and can be taken again. Back in 1912 railroad executives decided that something would have to be done about operating expense. Because fuel was the greatest single item of expense they focused their attention on it and as a result the International Railway Fuel Association became a most important factor in mechanical and transportation department activitives. The accomplishments of this association are best brought out by a comparison of the 1912 and 1929 figures. In 1912 Class I Railroads spent 224 millions for fuel and 158 millions for locomotive repairs, whereas by 1929 fuel was the third largest individual expenditure at $336,000,000, while locomotive repairs stood as the first or largest item at $409,000,000. In other words, in 1912 the expenditure for fuel was 41 per cent greater than the expenditure for locomotive repairs, whereas 17 years later the expenditure for fuel was 21 per cent less than the expenditure for locomotive repairs.

Stimulating Cooperation

You will no doubt agree that the Fuel Association, as an association, could not have accomplished what it did without the stimulating cooperation of railroad executives as well as the assistance of mechanical and maintenance officers, locomotive builders, and accessory manufacturers. It was, in reality, an organized, systematic, concerted effort on the part of all interested parties, concentrating on a single problem, and the results justified it.

Now that maintenance of locomotives and cars constitutes such a tremendous item of expense, and at a time when railroads are in dire need of profitable operation, it seems appropriate for the railroad executives to lay plans for establishing the maintenance shops on a sound manufacturing basis and to appoint and support an association of able men capable of cooperating with the various railroad departments and manufacturing concerns, in an organized, systematic, and concerted effort on that single problem.

Accuracy in Automatics

FRED B. JACOBS

Precision grinding makes possible the construction of machine tools which combine close limits with high productive performance

EXTREME accuracy in machine tool construction represents a gradual development that has taken place during the past 25 years. This is true especially with manufacturing automatic machines, equipped with multiple spindles for accommodating bar stock. When such machines first were put on the market, high production was the salient feature. Such tools found a ready market, as it was obvious that a machine, working simultaneously on six pieces of stock, would turn out six times as much work in a given time as a single-spindle machine.

Manufacturing automatics, as they are termed, are sold in a highly competitive market, and with the question of high production settled, came the demand for accuracy and still more accuracy in the finished parts they turned out. Some years ago if the product of such machines varied from 0.001 to 0.002 in. either way from given specifications the error was not serious because finishing operations on other machines followed. Often the manufacturing automatic was a roughing machine only.

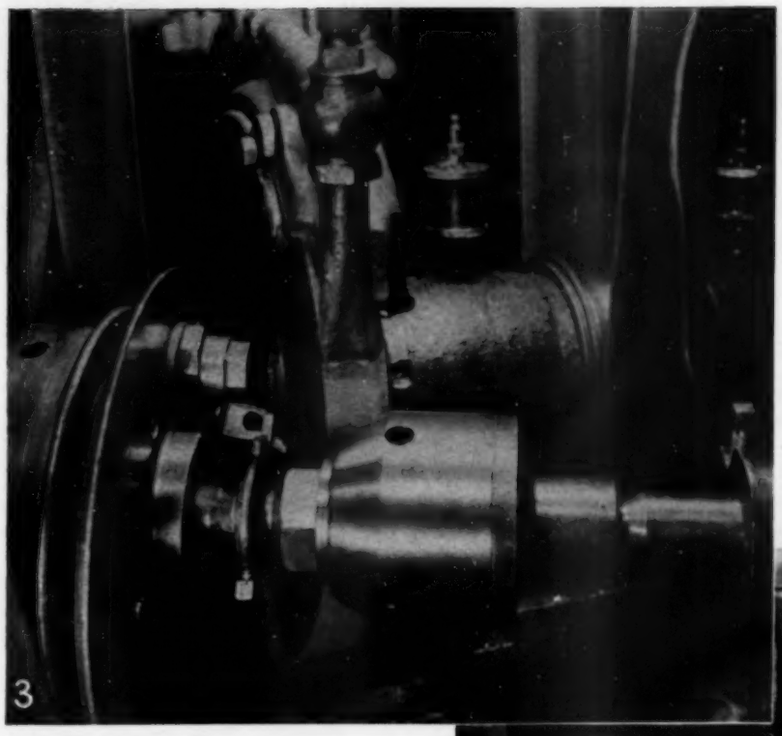
Today, however, the case is different. The manufacturing automatic machine must turn out a finished product to specifications calling for accuracy within 0.0001 to 0.0003 in. either way, from a given standard. To assure this close accuracy in the finished product, the machine itself must be built to exacting specifications, for no machine can impart accuracy that is not a part of it. Extreme accuracy is now assured by precision grinding of various parts entering into machine tool construction.

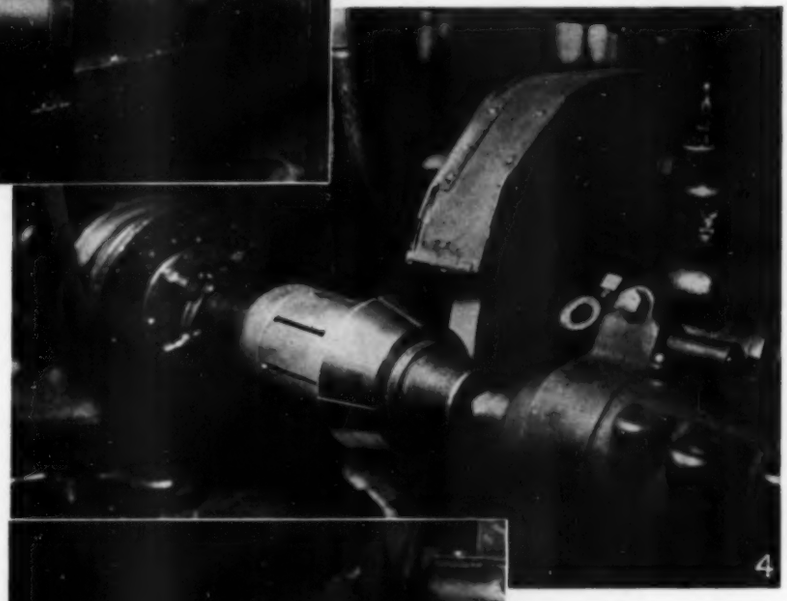
This article illustrates and describes a few grinding operations at the plant of the Cleveland Automatic Machine Company. This concern was a pioneer in the automatic machine tool field, having been in business for over a half century. The company's product consists of single- four- and six-spindle units; the grinding operations followed at present are a direct result of the demand for accuracy in machine tool construction.

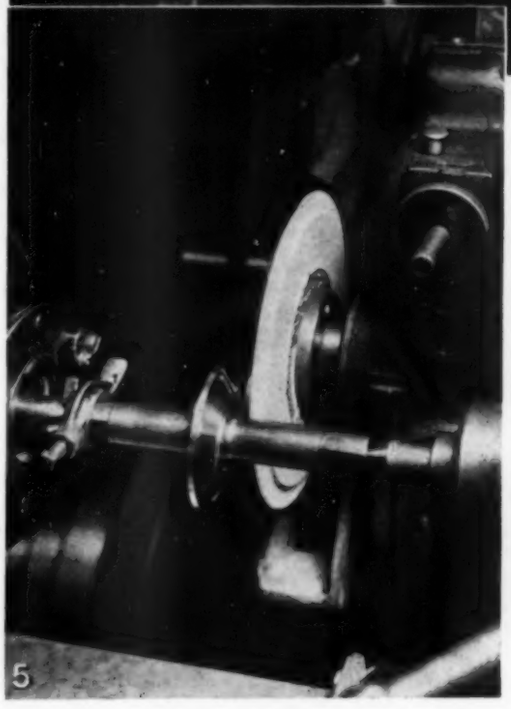
Fig. 1—Four surfaces on a nickle-iron spindle carrier are finished in one set-up

Fig. 2—A forged alloy steel gear blank is ground on the O.D.

The operation shown in Fig. 1 consists of finishing a nickel alloy cast-iron spindle turret for a four-spindle machine. The ground surface at the extreme left is 18⅝ in. in diameter and ¾ in. wide. The next ground surface







is 17⅝ in. in diameter and 4 in. wide. The third ground surface is 17⅝ in. in diameter and 4¼ in. wide, and the last surface 16⅛ in. in diameter and 1 in. wide. These four surfaces are finished at one setting of the work which assures concentricity which is quite essential.

As the illustration shows, the work is mounted on an arbor which is held between the grinding machine centers; the drive is in the usual way, by means of a dog coming against the face plate drive pin. No hard and fast rule is set for the speed of the work, but it generally approximates 25 surface f.p.m.

The machine used is a Norton gap grinder capable of taking work 96 in. long. The gap accommodates work 36 in. in diameter, while work 18 in. in diameter can be swung over the ways. The wheel used is 24 in. in diameter, 4 in. face, 3860 grit, *M* grade Alundum, and is operated at a surface speed of 5,500 f.p.m. The usual grinding allowance on this work is approximately ⅓₂ in.

The machine and wheel previously mentioned is also used for finishing a variety of other cylindrical work, a typical illustration of which is shown in Fig. 2. The part in process of grinding is an alloy steel forged gear blank, 11 in. in diameter and 1¾ in. face. The object of grinding the outside diameter is to insure the necessary accuracy of the over-all dimension before the teeth are cut. The work is placed on an arbor, held between centers and rotated at a speed of approximately 40 f.p.m.

Many cylindrical grinding operations require special set-ups, an example of which is shown in Fig. 3 where the operation consists of grinding the outer tapered portion of a hardened alloy steel chuck hood, 5 in. in diameter. The ground portion in the illustration in question is finished at an angle of 30 deg. from the center or 60 deg. included angle. As the illustration shows, the work is placed on a special arbor and held in place against a shoulder by a nut. The grinder platen is set over at an angle of 30 deg. and the wheel face trued accordingly.

This machine is a Cincinnati cylin-

Fig. 3—The 30-deg. tapered end of a hardened chuck hood is finished in a special arbor. Fig. 4—Finishing a hardened collet illustrates another taper grinding operation. Fig. 5 — A special high-speed steel circular cutter is ground with a wheel formed to shape by means of a diamond

drical grinder capable of taking work 16 in. in diameter and 48 in. long, fitted with an Alundum wheel, 14 in. in diameter, 1½ in. face, 3860 grit, *M* grade. This wheel normally is operated at a surface speed of 5500 f.p.m., while the work speed is about 50 f.p.m. The straight part of this work also is ground between centers, so that it is concentric with the tapered portion.

The part shown mounted for grinding in Fig. 4 is a hardened alloy steel collet for a 2 in. machine. These parts must be finished accurately so that the inner and outer surfaces are concentric. This machine is a Brown & Sharpe No. 2 universal grinder, fitted with an Alundum wheel, 12 in. in diameter, 1½ in.

Fig. 6—Three diameters in a tool steel spindle are internally ground in one set-up

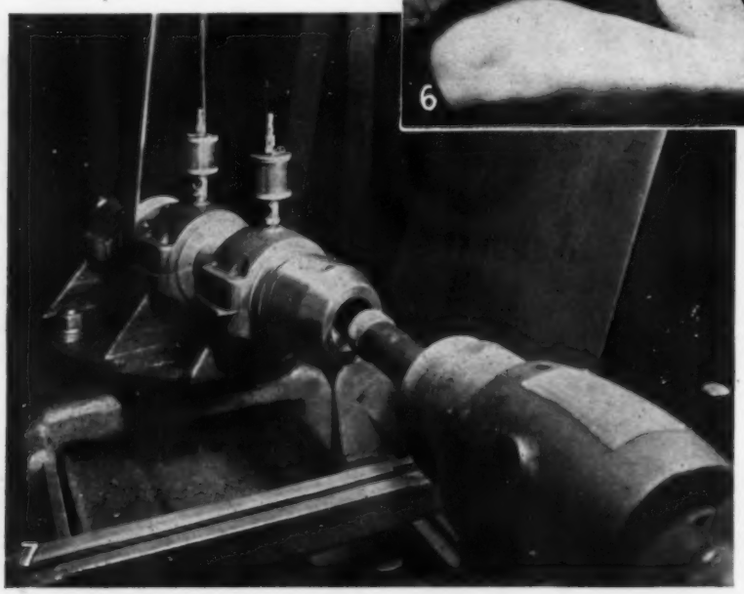


Fig. 7—A tapered hole is finished with the work screwed to the end of a special spindle

face, 3860 grit, *J* grade, operated at a surface speed of 5,000 f.p.m. The work speed approximates 60 f.p.m. In Fig. 4, the part is arranged for grinding the tapered portion, the grinder platen being set over 30 deg. The work is mounted on a special arbor and held between centers as shown.

After the tapered portion is ground, the arbor is taken out and mounted in another grinder where the remainder of the collet is ground. Two dimensions are finished, the fit at the back and the clearance between the back end and the tapered nose. Also, in this second operation, the back of the collet is faced off with the wheel side. Inasmuch as these four surfaces are finished one after an another without removing the work from its arbor, it is obvious that they will be true and concentric with each other.

Again referring to Fig. 4, it is shown that the slots are not cut entirely through. The object is to retain the collet as rigidly as possible until all grinding operations are finished. After the grinding operations are complete, the slots are cut through using a thin abrasive wheel with elastic bond.

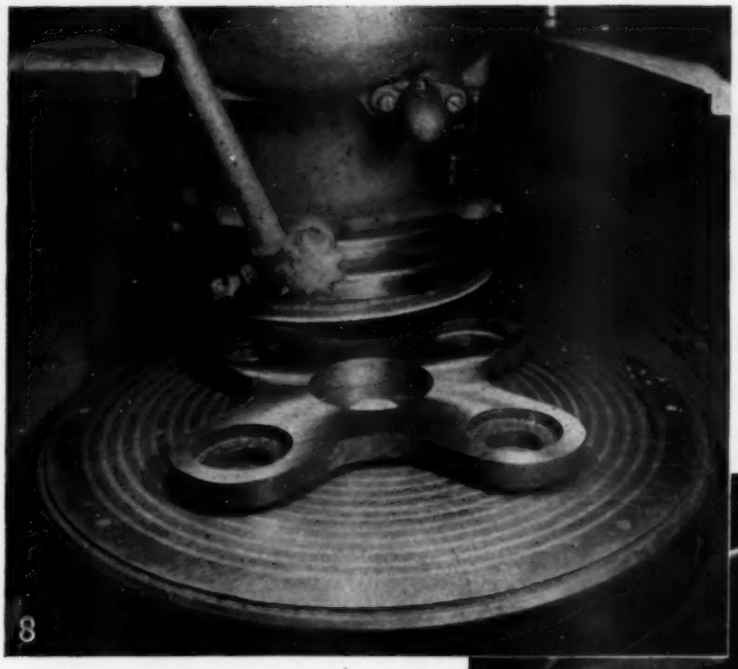
One of the most exacting grinding operations in the manufacture of the machines in question consists of grinding circular forming tools. As no two tools are exactly alike as regards contour of the cutting face, each presents a different problem. In Fig. 5 is shown the operation of generating a formed face on a high-speed steel circular forming tool with an over-all diameter of 2¼ in. The machine used is a No. 13 Brown & Sharpe universal grinder fitted with an Alundum wheel, 6 in. in diameter, ½ in. face, 19150 grit, *L* grade. This wheel is operated at a surface speed of 5,000 f.p.m., while the work speed is about 25 f.p.m.

By means of a diamond tool the operator forms the wheel face to the desired contour. This is a cut-and-try proposition as the form imparted on the work must fit a templet accurately enough to shut out light. As the illustration shows, the work is mounted on an arbor, held between centers and driven in the usual way.

Internal Grinding

Internal grinding operations are used freely in finishing a diversity of parts at the plant in question. In Fig. 6 is shown a hardened alloy steel tool spindle drum arranged for grinding. The job is not quite as simple as it appears from the illustration, inasmuch as it is necessary to finish three diameters at one setting of the work. The finished surfaces are 1.617 in. in diameter and 1¼ in. long, 1⅛ in. in diameter and 2 in. long, and 2⅛ in. in diameter and ⅞ in. long.

As the illustration shows, the work is held directly in the spindle chuck, and before grinding, it is trued up carefully with a dial indicator. This machine is a Heald internal grinder fitted with an Alundum wheel, 1½ in. in diameter, ½ in. face, 3,860 grit, *J* grade, operated at 10,000 r.p.m. The work speed is 250 r.p.m. In finishing the three diameters at one setting of the work, the three ground surfaces will be concentric which is the condition sought.



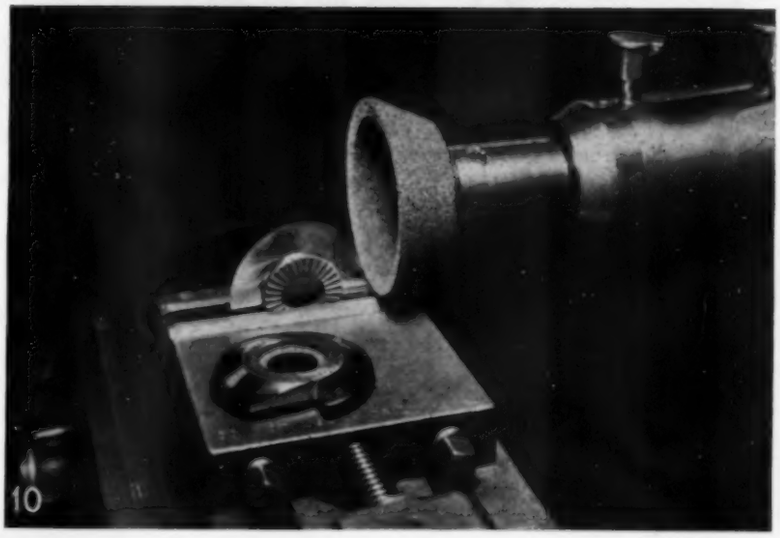


Fig. 8—Both sides of a spindle bearing retainer are surface ground in a magnetic chuck. Fig. 9—Eleven pieces are finished in one setting on a surface grinder. Fig. 10—A capped wheel is used to grind the gash on a circular form tool

The internal grinding operation, shown in Fig. 7, consists of finishing the inner taper diameter of the type of chuck head, shown in Fig. 3. The work is screwed onto the nose of a special spindle provided for the purpose, this spindle head being set over 30 deg. from the center line to generate the necessary angle. The ground hole is 2⅛ in. in diameter at the small end, and the ground portion is 1⅛ in. deep. The wheel used is Alundum, 2 in. in diameter, ½ in. face, 3,860 grit, *J* grade operated at 10,000 r.p.m., while the work speed is 150 r.p.m. The ground surface makes a bearing with the taper on the collet shown in Fig. 4, and because the chuck head is finished by locating it exactly as it fits in the finished machine, the ground hole will run true, which is absolutely necessary.

The surface grinding operation, shown in Fig. 8, consists of surfacing both sides of an alloy steel spindle bearing retainer. This part is 16½ in. in diameter and 1 in. thick. It is held directly on the rotary magnetic chuck of a Blanchard surface grinder. This chuck operates at a speed of approximately 20 r.p.m. The wheel is Alundum, 18 in. in diameter with a 2-in. cutting face, 3,830 grit, *H* grade, operated at a surface speed at the rim of 5,000 f.p.m. Parts surfaced in this manner have parallel sides within close limits. This machine is used for surfacing a wide variety of flat parts.

Another rotary table surface grinding operation is shown in Fig. 9. This machine is a Heald surface grinder fitted with an Alundum wheel, 12 in. in diameter, 1-in. face, 3,860 grit, *L* grade, operated at a surface speed of 5,000 f.p.m. The chuck runs at a speed of 25 r.p.m. As the illustration shows, eleven parts are set in place at one loading. These pieces are machine steel bearing retainers, 3½ in. in diameter, ¼ in. thick. Due to the broad contact on the chuck, it is not necessary in this operation to back up the pieces to hold them in place.

The surface grinding operation shown in Fig. 10, consists of cutting the necessary clearance on the circular form tool shown in Fig. 5. As Fig. 10 shows, the work is held in a vise and fed past a cupped wheel, 2½ in. in diameter, Alundum, 3,860 grit, *J* grade. This wheel is operated at a normal surface speed of approximately 3,000 f.p.m. on a Cincinnati tool grinder.

RADICALS

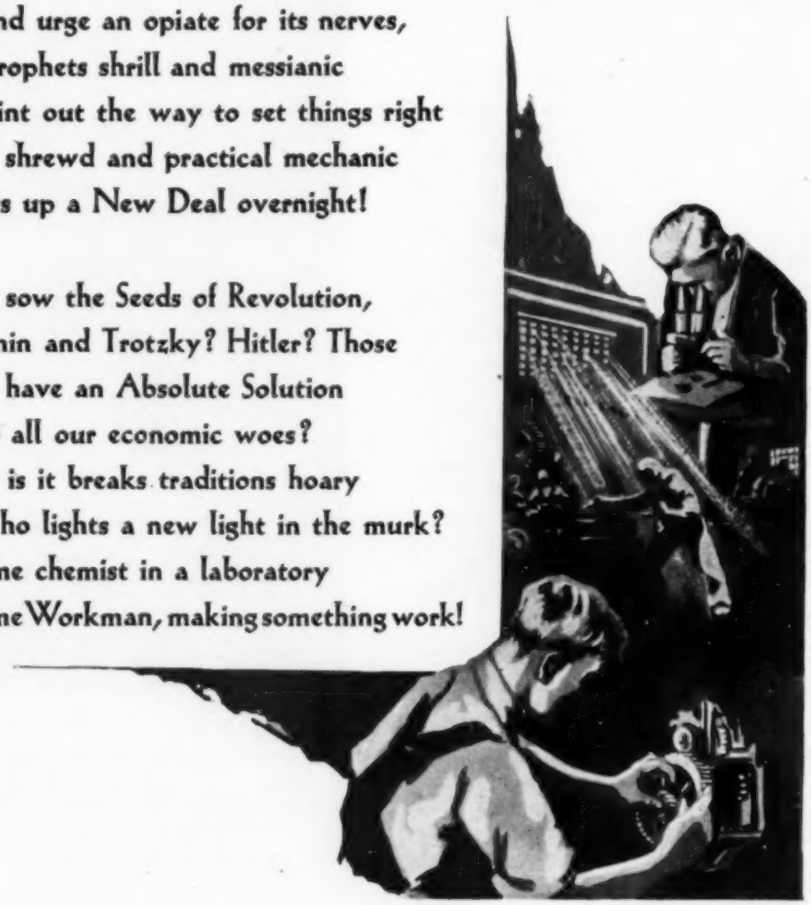
BY BERTON BRALEY

(Henry Ford says the real revolutions are scientific and industrial)

While politicians are debating
And theorists are having qualms
And agitators agitating
And communists preparing bombs;
While orators are aping Stentor
And all the air with clamor rings
Some quiet and obscure inventor
Is Revolutionizing Things.

While Experts plot the situation
With maps and diagrams and curves
Or pundits diagnose the Nation
And urge an opiate for its nerves,
Or prophets shrill and messianic
Point out the way to set things right
Some shrewd and practical mechanic
Sets up a New Deal overnight!

Who sow the Seeds of Revolution,
Lenin and Trotzky? Hitler? Those
Who have an Absolute Solution
For all our economic woes?
Who is it breaks traditions hoary
Who lights a new light in the murk?
—Some chemist in a laboratory
Some Workman, making something work!



EDITORIALS

VOLUME 79 AMERICAN MACHINIST ESTABLISHED 1877 McGRAW-HILL PUBLISHING COMPANY, INC. NUMBER 13

K. H. CONDIT F. H. COLVIN
EDITORS

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"Modernize for Profit"

UNDER some such slogan as the one above the Federal Housing Administration is moving to stimulate business in the equipment industries. The National Housing Act has been amended to increase the original $2,000 loan limit for any one property to $50,000, and the President has approved it.

Furthermore, the new class of modernization credit with the higher limit is being handled separately from the smaller loans which will be extended under the old regulations. Among the properties included in the new classification are "manufacturing or industrial plants." About the only type of equipment not covered by these loans is portable tools or machines that have no permanent connection (such as a belt or an electric cable or a tube) to the building in which they are located.

Those who manufacture or deal in machinery are urged by FHA to take full advantage of these new credit facilities by informing customers of their potentialities. Thousands of banks have qualified as lending institutions under the terms of the Act, and it should not be difficult, therefore, to get immediate action on deals where credit of this sort is appropriate.

The Act is extended until April 1, 1936. Under its terms every manufacturer has the opportunity to do the kind of selling job that put the Caterpillar Tractor Company and most of the domestic refrigerator companies, to mention only two types of manufacturers, strongly into the profit column. What these companies have done is to show their potential customers how to get FHA loans through their banks.

Ever since the latter days of the Hoover Administration industry has been struggling for a share in the government loans to various groups of citizens. Now, in addition to these FHA insured credits which can be used for replacement purchases, working capital loans are obtainable through the Federal Reserve Banks and the Reconstruction Finance Corporation. The rates are reasonable.

DOES industry really want this credit? Is it actually anxious to build its way back to prosperity? Has it finally regained enough courage to scrap its obsolete equipment and re-equip with accurate, cost-saving modern machinery?

Here is a golden opportunity, particularly for the smaller manufacturer. He should join his larger fellows in "Modernizing for Profit."

'Ware the Sherman Act!

WASHINGTON has been at pains to warn business and industry that the Sherman Anti-Trust Act has never been repealed. Under NIRA certain of its provisions were suspended. Now that NIRA has been declared unconstitutional the nice legal question arises as to culpability under the Sherman Act for actions taken by code members.

Whether actions contrary to the Sherman Act performed by men who thought their NRA codes made them permissible are to be prosecuted by the Attorney General remains to be seen. While such suits may not be probable they are distinctly possible. The Federal Trade Commission has already started to move against certain groups on information placed with it, possibly by disgruntled competitors.

The course of wisdom is to be doubly careful of committing any act that might be construed as contrary to the spirit or the letter of the Sherman Act. Not only is it unwise at a time when the government is looking for a chance to catch business in the wrong, but it is bad strategy while business is trying to prove that it can recover if given half a chance.

Demand for skilled machinists is exceeding the supply, and, if our information is correct, this state of affairs has led so-called training schools to use it as bait. At least one of these schools is reported to be advertising to train boys or men in from three to five months so that they can command top wages in the industry. No boy or man should be misled by any promise of such a short cut to success. Many trade schools are giving an excellent foundation in a comparatively short period, and with this as a basis a bright boy who has mechanical ability can make rapid progress. Employers will do well to encourage good pre-shop training, and to discredit schools which make impossible claims.

. CHIPS .

Washington—As New Deal expenditures reach $15,000,000,000 talk of additional taxes spreads . . . Federal Communications Commission orders heads of telephone, telegraph and radio companies to drop extra directorates . . . Deputy collectors of internal revenue start collecting statistics on effect of Schechter case decision, admit they cannot enforce requests but hope for voluntary cooperation . . . Senate passes Utility Bill after killing softening Dieterich amendment by one vote . . . House Interstate Commerce Committee extends term of Coordinator Eastman for another year but cuts out assessment on railroads which provided funds for his work . . . Secretary Ickes advocates permanent, advisory National Planning Board . . . Roosevelt issues executive order setting up skeleton NRA organization to carry on until April 1, 1936.

Foreign—After several days of hectic stewing the French pot boils and a coalition cabinet headed by Laval wins power to sustain franc by decree . . . Across the Channel cabinet jobs are quietly shuffled and re-dealt bringing Baldwin back into prime ministry . . . Impending Japanese incursion of Peiping area worries British and American diplomats . . . Chinese forces withdraw from area . . . China refuses Japanese demands . . . Mussolini sends another army division to Africa and warns Great Britain and League not to interfere with his "empire" program, bars New York Times from Italy because of criticisms . . . Outcome of Chaco truce to be peace, it is hoped . . . Hitler approves agreement which places German naval strength, in each category, at 35 per cent of England's.

Finance—Regular June Treasury financing to consist of exchanging $416,000,000 of 3 per cent notes due June 15, and $354,000,000 of 1⅝ per cent notes due August 1 for 5-year 1½ per cent notes . . . National debt expected to remain below $29,000,000,000 . . . Interest rate on Work Relief loans raised to 4 per cent in effort to force borrowing from local banks and make PWA funds go further . . . Morgenthau reports purchase of 421,500,000 ounces of silver to prove that he is following out buying policy . . . Usual notices of default on war debts begin to arrive . . . Congress passes joint resolution extending for three years the time allowed bank officers to repay loans.

Industry—Labor demands new NRA, 30-Hour Bill, Guffey Coal Bill, Wagner Bill and Social Security measure . . . Steel leaders, in convention, vote to maintain wages and code hours . . . Cotton textile industry reports few deviations from code standards . . . International Labor office favors 40-hour week . . . Rumors of steel price cuts are floating about . . . Ford's 2,000,000th V-8 comes off the line.

Trade—American business men alarmed at Japan's evident intent to drive them out of China . . . Many millions of investments at stake.

Indicators—Steel production continues to recede . . . Electric power output rises . . . Business Week's Index drops half a point to 63.5.

FHA Loans and FTC Codes Seen as Aids to Industry

WASHINGTON—Industry is on the spot. Those industrialists who blamed NRA for their troubles will have a chance to demonstrate between now and next April that they can maintain high standards in wages, working conditions and trade practices without "regimentation." If they succeed the Administration will find it difficult to revive rigid regulation. If they fail, bigger and more binding forms of Federal control are almost certain to follow.

Apparently the President does not expect that business, operating on its own, can show as fine a record of good behavior as it did under NRA.

After the Supreme Court decision which knocked the props out from under one of the most prominent instruments in the New Deal, he seemed to hesitate between a policy of letting things take their course and one of urging enabling legislation to save the best in NRA. Actually he did neither but instead recommended a fact-finding organization, based on the remnants of the Blue-Eagle bureaucracy, whose principal function will be to prove that business cannot run itself. Frankly the President has no faith in the ability of business voluntarily to keep chiseling backsliders in line and to march on to recovery.

State Compacts Turned Down

He has even less confidence in the effectiveness of maintaining code wage and lower standards by interstate compact. In the hectic week following the Supreme Court's decision, state legislators and labor officials were called to Washington from New England and other states where this idea had taken hold. They framed an indorsement of the McCormack resolution, giving the blessing of the federal government to negotiation of such compacts by the states, but their recommendation for its inclusion by the President in his stop-gap program was rejected.

In his indorsement of the Wagner bill and his threat of renewed prosecution under the Sherman anti-trust law, the President indicates that he is unwilling to help business help itself. By arming labor, enactment of the Wagner bill will harass industry during a critical period by subjecting it to employee dictation. A return to rigid interpretation of the anti-trust laws will mean that the gains made in many industries to improve trade practices will be lost.

Despite the handicaps thrown in its path business is privately jubilant at the opportunity given it to go ahead under its own steam. At the moment the feeling of relief over the demise of one form of control is overshadowing the real job of recovery under a new set of conditions. For while this turn of Fate and the Supreme Court holds hope of independence it also harbors potential disappointment.

New FHA Loan Policy

The Federal Housing Administration is one government body that should do much to offset deterrent forces on business from other sources. On May 28, FHA's modernization credit plan was extended to include all commercial and industrial property — machinery and equipment as well as buildings. Loans up to $50,000 will be fully insured up to 20 per cent. Interest rates and charges may be as low as consistent with the character of the business but may not exceed the equivalent of $5 discount per $100 per year. Notes must be paid in equal monthly installments with a final maturity of not more than five years.

Regulations under the new amendment to the National Housing Act are now in the hands of 13,500 financial institutions which have extended $80,000,000 of credit under the old $2,000 limit for home modernization. In addition to the former scope of FHA activity, loans may now be obtained for the purchase and installation of equipment and machinery with or without structural changes in the building. The application of this broad ruling will be left largely to the discretion of the lending institution which advances the credit.

New provisions, applying to this type of loans as they appear in the FHA revised regulations, follow:

24. An advance of credit in excess of $2,000 but not in excess of $50,000 must have been made for the purpose of (1) repair, alteration, or improvement of real property already improved by, or to be converted into, apartment or multiple-family houses, hotels, office, business or other commercial buildings, hospitals, orphanages, colleges, schools, or manufacturing or industrial plants, or (2) the purchase and installation, in connection with the foregoing types of property, of such equipment and machinery, with or without any structural changes in the buildings, as are peculiarly adapted to the business conducted therein or necessary to the operation thereof.

25. Where an advance of credit is for any of the purposes set forth in Regulation No. 24, any number of notes may be executed in connection with any number of pieces of property, but not more than $50,000 may be expended on any one piece of property.

26. The insurance reserve calculated on notes evidencing advances of credit from $2,000 to $50,000, for the purposes set forth in Regulation No. 24, will be calculated separately from the insurance reserve calculated on notes evidencing advances of credit not in excess of $2,000, and claims on either class of notes will be paid only out of the respective insurance reserves.

27. Any security taken by an insured institution must be assigned to the Administrator in event of claim under the Contract of Insurance. If the security taken is non-assignable, all rights in such security must be exhausted by the insured institution or the claim against the Administration reduced by the full face amount of the security taken before claim will be paid by the Administrator.

Another source of assistance in industry's struggle to resuscitate itself lies in the action of the Federal Trade Commission in reopening its doors for

Some Answers on FHA Loans

What do the revised FHA regulations mean to industry?

The modernization credit plan has been broadened to include equipment and machinery as well as buildings.

How large a loan may be obtained?

FHA will now guarantee 20 per cent of loans up to $50,000 as compared to the old limit of $2,000.

Will companies obtaining such loans be under obligation to the government and thus expose themselves to increased regulation?

No. All loans will be made by banks and other approved regular sources of commercial credit. FHA acts merely as a limited guarantor.

Can more than one loan be obtained?

Yes. Each individual property is entitled to a loan of $50,000 if other conditions are satisfied.

Where can such a loan be negotiated?

At any bank or other financial institution that displays the FHA "house in the circle" sign. In case of doubt, a letter direct to FHA will determine the name of a local qualified source of credit.

What conditions must be met to obtain an FHA loan?

The lending institution must be satisfied that the borrower is a reasonable credit risk and in a position to amortize the loan.

How and when must it be amortized?

In equal monthly payments extending not over five years.

How much does it cost?

Anything agreed upon by lender and borrower except that the total interest and other charges must not exceed a $5 discount per $100 face amount per year (9.716 per cent).

When can FHA loans be obtained?

Anytime before April 1, 1936.

Can they be used for all types of equipment?

Yes; except such portable items as unattached bench tools, typewriters and desks.

the submission of voluntary codes. From 25 to 30 have already applied to the Commission either to revive codes in effect prior to the NRA régime or to write new codes.

The American Petroleum Institute and other organizations have been advised that the Commission will be pleased to consider such proposals. The few industries that have asked blanket approval of their NRA codes will be disappointed—the very fact that NRA approved them seems to be regarded as grounds for suspicion.

Codes approved under its old procedure dealt only with trade practices, as the Commission has no jurisdiction over wages, hours and working conditions.

The Trade Commission shed no tears over NRA's demise as it regarded the Blue Eagle as poaching on its preserves. Senator Nye is reviving the bill, originally proposed when the Trade Commission crossed wires with the Department of Justice, under which voluntary codes when scrutinized and approved by the Commission would be *prima facie* evidence that the provisions agreed to are not in violation of the anti-trust laws.

Total Machine Tool Sales Set a New Five-Year Record in May

Domestic machine tool sales for April were the best in five years, but total May business (domestic and foreign) was the best since 1930. The gain over April in total business was 12 per cent, lifting the index to 73.3. This is not much below the fifteen-year average for the industry of 76.2. Moreover, the three-months moving average, which hovered around the 60-61 level for four months, took a decided jump to 67.1. Whereas the usual seasonal trend would be expected to cause a downward drift for the next month or so, this contra-seasonal movement can be expected to pad the drop if it comes.

Because of the suspension in NRA activities, the number of contributors to the May figures dropped to 138. The statistical work on behalf of the industry has been taken over again by the National Machine Tool Builders' Association, and 70 non-member companies will continue to supply figures. Of this number 57 contributed to the May tabulation. It should be noted that the 138 companies in the May compilation represent 92 per cent of the base volume reported by the largest number of companies in the index in any one month (February, 1935).

Distributions of orders, Table III, shows that in April there were 103 out of 169 companies that did less than 60 per cent of their average business in 1926. For May there were 83 out of 138 companies in the same position. These figures show that the less fortunate companies constituted 60 per cent of the entire group in both April and May.

The index of orders, by size of companies, Table II, discloses that the large and small companies both attained the same index figure, 57.3, for domestic business. In the home market the greater gain was made by the smaller companies. Sales abroad went in favor of the larger companies, these having increased their position by a change in the index for April of 11.8 to 16.7 in May, and a gain in the percentage of foreign orders of 18 per cent in April to 23 per cent in May. The smaller companies lost ground both with respect to the index of foreign orders and to the percentage of the total. Whereas May found the larger companies with 23 per cent of their sales from abroad, equivalent to December (the best previous month), the smaller companies experienced a drop in foreign business to 5 per cent of the total as compared to 12 per cent in December.

Table I—Index of Orders Based on Volume of Shipments for 1926

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1934—November	43.1	9.3	52.4	44.2	17
December	51.5	14.6	66.1	54.1	21
1935—January	52.0	13.5	65.5	61.3	20
February	41.2	10.9	53.0	61.5	20
March	48.5	13.8	62.3	60.3	21
April	54.5	11.2	65.6	60.3	17
May	57.3	16.0	73.3	67.1	21

Table II—Index of Orders—By Size of Companies

Group A—Companies reporting year's sales in 1926 of $200,000 or more:

Month	Index of Orders: Domestic	Foreign	Total	No. of Reports	% Foreign to Total Orders
1934—November	43.4	9.8	53.2	89	19
December	51.3	15.1	66.4	91	23
1935—January	51.6	14.3	65.9	91	22
February	42.1	11.4	53.5	98	21
March	48.0	14.4	62.4	94	23
April	54.8	11.8	66.6	94	18
May	57.3	16.7	74.0	83	23

Group B—Companies reporting year's sales in 1926 of less than $200,000:

1934—November	38.7	2.1	40.8	82	5
December	55.6	7.3	62.9	76	12
1935—January	57.1	1.9	59.0	78	3
February	42.1	4.5	46.6	81	10
March	55.7	5.5	61.2	78	9
April	48.0	3.8	51.8	75	7
May	57.3	3.2	60.5	55	5

Table III—Distribution of Orders

(Shown by indexes of individual companies)

New Orders in % of 1926 Shipments	Number of Reports in Each Index Group: Nov.	Dec.	Jan.	Feb.	Mar.	April	May
200 or more	4	9	10	6	6	7	6
100–199	15	25	21	19	25	21	21
90–99	4	5	5	5	8	3	8
80–89	4	4	10	3	5	9	3
70–79	7	6	8	10	9	13	11
60–69	9	7	10	8	7	13	6
50–59	12	18	19	18	15	13	8
40–49	16	16	13	18	21	16	9
30–39	16	14	12	21	21	14	11
20–29	17	17	21	23	13	17	15
10–19	23	24	22	18	23	18	11
Less than 10	44	22	27	30	19	25	29
Total Reports	171	167	169	179	172	169	138

Gear Makers Approve Hours-Wages Program

Members of the American Gear Manufacturers Association on June 11 expressed unanimous approval of resolutions for hours of employment and wages for the industry. The resolutions follow:

"HOURS. Since the opinion of the majority of our Industry that 40 hours as a base is satisfactory, provided the limitations on overtime are removed, and that for computing payroll purposes the 40-hour week should be established with unlimited overtime over 40 hours, provided time-and-a-half is paid for such overtime, we recommend this as the standard practice for the American Gear Manufacturers Association members.

"WAGES. The wages paid in our Industry have proved very satisfactory and we recommend that no downward revision be made."

Auto Makers Machinery Policies Return to Pre-Depression Status

DETROIT — Sentiment in machinery lines continues optimistic with inquiries reported 100 per cent ahead of last year but sales still slow in materializing. Equipment policies of some of the larger units are back to a pre-depression status. Thus, purchases will be considered if savings can be shown in six months to a year or more. Quotations are invited on operations which a few months ago would not even be considered. It is reported that extensive purchases for the Ford French and English plants are being made, and hold orders on developments in cylinder machining in one large producer plant are being relaxed. Present slowness in sales of machinery is not to be considered serious because sufficient time remains to build complicated machines before new-model production must be started. Further basis for encouragement is found in sales of a machine here and there to small concerns which have not shown any interest in five years.

Tool Shops Pick Up

Tool and die shops show a trend counter to that of the assembly plants. From a January peak operations dropped through February and March to a low point in April. In May some pick-up was noted in the larger shops. Several companies are contracting for large die work but the peak in preparation for new models will likely not be as great as in former years because of a wider spread in introductions. With the passing of the codes the hour disadvantage which these shops have experienced as compared with captive tool shops no longer exists. It is understood that sentiment exists for a 48-hour week with time and one-half for over time.

Suppliers' schedules are showing a more drastic reduction than assembly plant output because of inventory balancing over Memorial Day. June business in some quarters is half of that for April. Other suppliers show a reduction in commitments up to 35 per cent for the last two weeks of June and the first two weeks of July. With such a high output the first five months of the year, supplier's operations for the year are expected to be on a profitable basis. This is contingent on enough business during the last half to carry the overhead, a requirement which bids fair to be realized. With the show date set for November 2, the down period is likely to occur during August and September with October reserved for building up dealer stocks. Last year was a body-change year, and it is likely that less extensive changes will be made for the '36 introductions, in which case suppliers will be in a very favorable condition for continuous operations.

What effect the break-up of the codes will have is a live topic in the industry. Strong recommendations have been issued to members of the three codes primarily concerned—the assembly industry, the automotive parts and equipment manufacturers, and automobile retailers—to maintain the *status quo*. Directors of the last two code authorities have voted to continue operations as formerly. Manufacturers are requested to assure employees that no changes will be made in hours and wage rates and to continue to furnish employment and sales figures to the code authority. In the parts industry the code authority will function as an administrative committee.

The status of bargaining agencies set up under automobile labor board rules is decidedly uncertain. In general, managements are favorably disposed and value the results already obtained. Interest on the part of employees is likely to depend upon management.

Output of motor vehicles in the United States and Canada for May was 377,754 units as contrasted with 501,837 in April. Output for the first five months was 1,988,637, a 35 per cent increase over last year. June is expected to fall below May by a considerable margin, although only a 5 per cent decrease is predicted in some quarters. Chevrolet is back to capacity with a June schedule understood to be 125,000, which should compensate to some extent for reductions in other quarters. Another favorable factor in the June outlook is the decided strengthening of retail sales in the last part of May and the first of June.

April registrations totaled 366,437 according to Polk figures as compared with 302,988 in March. May is expected to fall between these two totals. There appears to be an upward trend

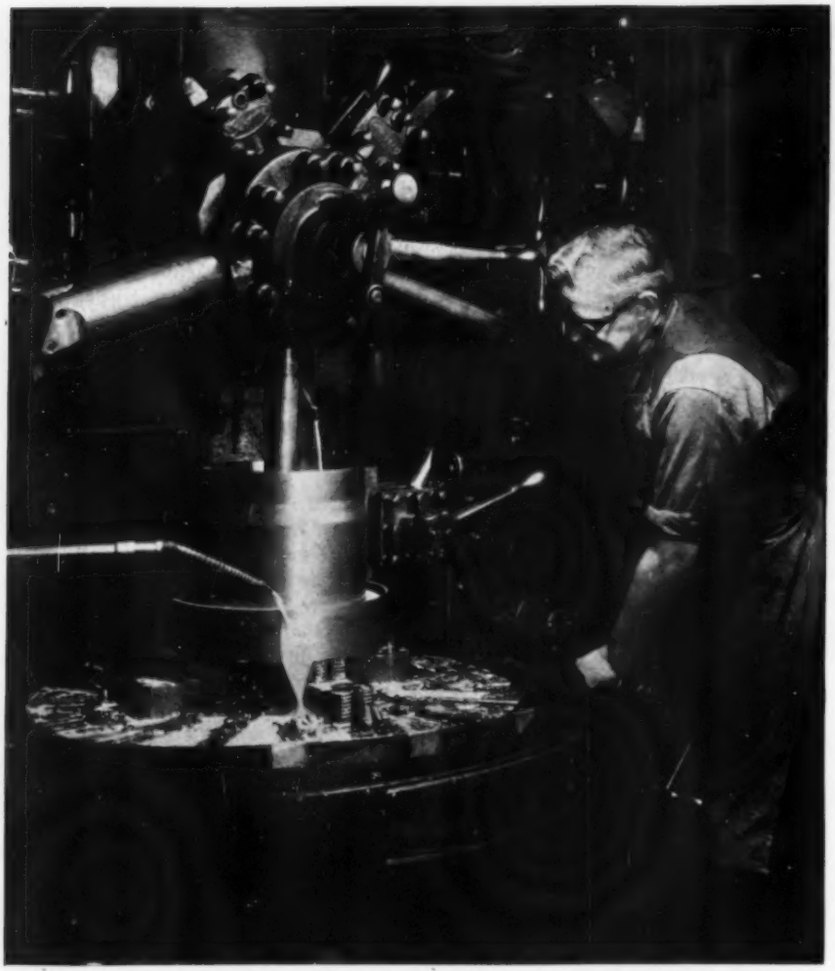
• INDUSTRIAL REVIEW •

• In most of the big industrial centers orders for machine tools, supplies and equipment are holding up well for this season of the year. Generally speaking, the end of NRA as a compulsory code organization has had little effect on business, one way or the other. Orders postponed by cautious buyers who want to "wait and see" have been balanced by orders released by buyers who have looked on NRA as a restraining hand on business. Machine tool price increases are imminent.

• At the moment orders are definitely down in the Boston territory but distributors there look on this situation as temporary. In New York and the metropolitan area business has held up very well during the first half of the month. Some government business has been placed in the Philadelphia area but other orders are quiet. Sentiment is optimistic. Big orders have been few in the Pittsburgh district but a steady trickle of single machine orders has kept things moving.

• While orders have been falling off in Cleveland inquiries are numerous and are expected to lead to considerable activity in the near future. There is a serious shortage of skilled machinists and even of some types of machine operators. Detroit has entered into the quiet period, supply business in particular having dropped off seasonally. Interest in replacement of standard machine tools is on the increase and there are encouraging inquiries for special-purpose machines. In Indianapolis the second quarter is expected to equal the first in volume.

• Cincinnati buyers are showing a strong tendency to hesitate in placing orders. The first half of June has not been up to the May average on machine tool orders. Activity in the local machine tool plants is greater on special-purpose than on standard tools. Labor conditions are fairly good. Chicago and Milwaukee are experiencing surprisingly good business for the beginning of the summer season. Part of it is caused by early activity on the part of the automotive industry. In the Far West both orders and inquiries have picked up since the passing of NRA. Distributors are decidedly more optimistic than they have been for a long time.



***Thirteen in One*—It's not bad luck when thirteen distinct operations can be performed in one set-up. That is exactly what Westinghouse is doing on the commutator bushing shown above. This piece is to be used in one of the 4,600 hp. locomotives being built for the Pennsylvania R.R. After machining to a 0.001 in. tolerance the bushing is polished on the boring mill**

over the last half of May. De Soto sales are up 10 per cent; Olds sales the last ten days of May bettered the second ten days by 25 per cent; Ford and Lincoln scored the second highest ten days in sales in five years; Hudson-Terraplane sales increased 12.5 per cent on the week ending June 1 over the previous week. Packard, Pontiac, Cadillac-LaSalle, Plymouth, Buick, Dodge and Chrysler also report sales increases. May sales by General Motors to United States consumers totaled 109,051 as compared with 143,909 in April.

The employment curve in Detroit, after remaining almost constant at slightly better than 240,000 during February, March and April, dropped 20,000 between May 1 and June 1, one large producer reporting a sales pick-up the last of May reduced the force by 20 per cent on June 3.

Industrial Relations Is Silver Bay Topic

At the eighteenth annual conference of industrial executives at Silver Bay on Lake George, N. Y., Aug. 28-31, the program will take up various phases of industrial relations. Collective bargaining and social security as subjects of interest to government and industry will be discussed, to be followed with training, wage incentives and revaluation of a personnel program as current problems. Speakers will be chosen from industry, labor and government. The program is under the auspices of the industrial department of the National Council of Y.M.C.A.'s in cooperation with a committee of representative industrial men. E. C. Worman, 347 Madison Ave., New York, N. Y., is executive secretary.

NIRA Administration Cost Many Millions

For the two-year period ending this month the total cost of administering the NRA and its 578 codes totaled $93,884,595, according to a study made by the National Industrial Conference Board. Additional costs not included in the foregoing involve the expenses of code formulation, outlays of individuals attending hearings, and litigation expenditures in connection with code enforcement. Nor does this total include the added cost of manufacture under the codes, nor business men's time spent on code problems. The $93,000,000 total represents only the general administrative costs that the code system has entailed for industry and the Government.

Distribution of the cost is as follows:

Code authority expenditures	$71,704,406
National Recovery Administration	18,110,091
Interior Department, administration of Petroleum Code	2,214,963
Agricultural Adjustment Administration, code administration	565,646
National Labor Relations Board	1,214,489
National Steel Labor Relations Board	25,000
Textile Labor Relations Board	50,000
Total	$93,884,595

Farm Machinery Exports Lose Ground in April

Exports of agricultural machinery in April declined 13.5 per cent as compared with March, but still were 9.5 per cent above April, 1934, according to a report by the Machinery Division, Department of Commerce. The business in April was worth $2,221,336, a year ago $2,026,953, and in March, 1935, $2,568,283. Tractors and parts accounted for $1,283,536 in April as against $1,137,054 in April, 1934. The increase resulted from larger shipments of wheel tractors, 709 units as against 534 units. Tracklaying tractors declined from 254 units to 204 units. Plows, harrows, cultivators, planters, and drills gained 19 per cent, the value being $349,341 as against $292,593 a year ago. Cultivators gained the most. Harvesting machinery decreased 27.6 per cent, that is, from $271,515 in April, 1934, to $197,323 in the same month this year. The loss is accounted for by the decline in shipments of combines which decreased from a total of 124 to 35 units.

More Machinery Firms Show Better Profits

An increase in 1934 as compared with 1933 in the net earnings of industrial machinery manufacturers is shown in a compilation made by the Machinery Division of the Department of Commerce. A study of the net earnings of 74 firms showed that 27 firms reported earnings totaling $15,277,000 while 47 reported deficits amounting to $23,004,000 in 1933. The picture was entirely changed in 1934 when of the same 74 firms, 45 reported earnings totaling $26,841,000 and only 29 reported deficits amounting to $10,883,000. Manufacturers of agricultural machinery failed to show the same measure of improvement as did manufacturers of industrial machinery.

Federal Specification Requested for Gages

The Federal Specifications Section of the Procurement Division, Treasury Department, Washington, has sent out a proposed specification for gages—wire, sheet metal, and twist drill. Offered for approval by industry the specification covers circular gages and rectangular gages.

• PERSONALS •

ALBERT D. WILSON has been elected president of the Bristol (Conn.) Brass Corp. to succeed ALEXANDER HARPER, who died June 4. Mr. Wilson began with the company 33 years ago. In 1929 he was elected vice-president.

HERBERT H. PEASE, president of the New Britain-Gridley Machine Co., New Britain, Conn., has been named a councillor of the Durable Goods Industries Council.

LYMAN C. ATHY has been appointed superintendent of manufacturing operations for the new plumbing division of the Briggs Manufacturing Co., Detroit, Michigan. Formerly, Mr. Athy was in charge of enameling and research for the General Electric Co.

E. A. CARPENTER has been elected secretary of E. F. Houghton & Co., Philadelphia, to fill the vacancy caused by the recent death of A. EVERLY CARPENTER, III.

R. L. RICHWOOD has been appointed superintendent of the Blanchard Machine Co., Cambridge, Mass.

WISER BROWN has been named plant manager of the United States Aluminum Co., Fairfield, Conn., to succeed the late SIDNEY K. BECKER.

FRANK J. TONE

FRANK J. TONE, president of the Carborundum Co., was awarded the honorary degree of Doctor of Science, by the University of Pittsburgh. Mr. Tone has been most active in two major industries—synthetic abrasives and super-refractories. One of his early accomplishments was the commercial production of metallic silicon. He has received many medals in recognition of his work, and has been honored by many scientific societies.

Exports of Machinery During April, 1935

	April 1935	March 1935	April 1934
Electrical machinery	$6,779,526	$6,635,810	$5,616,661
Power generating machinery (except automotive and electric)	894,015	721,962	487,761
Construction and conveying machinery	557,771	536,163	527,329
Mining, well and pumping machinery	2,261,462	3,147,378	1,582,840
Power-driven, metal-working machinery	2,179,256	1,964,620	2,463,052
Other metal-working machinery	229,428	222,156	483,903
Textile machinery	741,228	717,487	561,402

Exports of Metal-Working Machinery During April, 1935

	April 1935	March 1935	April 1934
Engine lathes	$262,287	$85,646	$146,618
Turret lathes	70,597	136,914	54,286
Other lathes	77,163	64,192	54,367
Vertical boring mills and chucking machines	75,358	37,302	7,121
Thread cutting and automatic screw machines	111,847	69,987	124,249
Knee and column type milling machines	104,004	106,961	100,044
Other milling machines	108,195	76,281	180,888
Gear cutting machines	92,229	129,417	177,400
Vertical drilling machines	46,278	12,668	219,545
Radial drilling machines	27,825	17,949	25,637
Other drilling machines	113,517	88,600	330,518
Planers and shapers	21,041	55,879	4,977
Surface grinding machines	46,823	57,574	20,668
External cylindrical grinding machines	121,232	56,140	69,206
Internal grinding machines	76,573	99,470	132,428
Tool grinding, cutter grinding, and universal grinding machines	68,126	80,203	73,251
Other metal-grinding machines	59,049	65,335	64,772
Sheet and plate metal-working machines	203,273	141,444	296,963
Forging machinery	101,546	255,123	75,083
Rolling mill machinery	113,929	71,327	78,329
Foundry and molding equipment	41,425	28,748	20,692
Other power-driven metal-working machinery and parts	236,939	227,460	215,010

Other Metal-Working Machinery

Pnuematic portable tools	63,298	66,924	86,965
Other portable and handor foot operated metal-working machines and parts	69,293	58,822	59,649
Chucks for machine tools	11,680	14,309	7,404
Machine operated pipe and thread cutters, stock, dies, taps and other machine-operated cutting tools	37,402	42,601	315,989
Other metal-working machine tools	38,755	39,500	13,896

• OBITUARIES •

George F. Ballou

While only those whose memory of things mechanical dates back into the last century are likely to recall George F. Ballou, his passing on June 10, at the age of 90, brought to a close a career more varied than falls to the lot of most mechanics. Leaving school at the age of 12 and quitting his first job at tanning because of the unpleasant odors, he was apprenticed to Cole Brothers of Providence, R. I., makers of fire engines, graduating into rifle work just before the Civil War. His aptitude for the work may be judged by offers of $2 a day from several concerns, an unheard-of wage for a boy of 14, especially in 1860.

After the war, for which he enlisted at 16, he worked with Brown & Sharpe in their old shop, then went into sewing machine building, and then with such watchmakers as Hampden, Howard, Elgin and Waltham. Later, under the name of Ballou & Whitcomb, he built watchmakers' lathes. This evidently led to the development, about 40 years ago, of the Ballou engine lathe in which the carriage ways were dovetailed to the front of the bed. He also worked with Professor Rogers of Harvard on his astronomical devices, with

Edison in his earlier experiments, on special machines for the Bureau of Printing and Engraving, and on typewriters. Pencil sharpeners of the rotary type were among his later developments. George Ballou was an excellent mechanic and a typical inventor and though he profited little by his long years and many inventions, most of us have benefited by them, even if indirectly.

GEORGE W. BUTZ, 69, superintendent of the architectural mill department of American Car & Foundry Co., Wilmington, Del., and identified with that concern for the past 54 years, died June 3.

CHARLES P. DICKINSON, 81, former partner of IVOR SIKORSKY, in the Sikorsky Airplane Co., died at Boston, June 11.

WALTER A. STONEHAM, founder and president of the Federal Tool & Machine Co., and the Stoneham Engineering Co., Dayton, Ohio, died recently, after a brief illness.

FRANK S. STORMS, president of Storms Drop Forging Co., Springfield, Mass., died June 2. Mr. Storms was 71 years old.

FREDERICK A. TECKTONIUS, president of the E. C. Tecktonius Mfg. Co., Racine, Wis., died June 6. Mr. Tecktonius was 56 years old.

FRANK S. WATERS, 57, president and —with his brother—founder of Lyon Metal Products Co., Aurora, Ill., died June 6.

• BUSINESS ITEMS •

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, general distributors for Boye & Emmes lathes, Dreses radial drills, Kling heavy duty grinders, Ohio shapers and horizontal boring machines, Cleereman heavy duty drilling machines and Swift flash, spot and projection welding machines, has appointed W. G. Nichol Co., 711 W. Michigan St., Milwaukee, as exclusive agent in the Milwaukee territory.

The John Waldron Corp., New Brunswick, N. J., manufacturers of the Franke coupling and silent steel gears, will handle direct, after July 15, the sale of these items instead of through Smith & Serrell, Newark, N. J. F. W. THOMAS, former New York district manager of the coupling division, Bartlett Hayward Co., has joined the staff of the John Waldron Corp., as general manager of the new departments handling the above items.

The machinery and equipment of the Oswego Tool Co., Oswego, N. Y., manufacturers of plain and swivel machinists' vises, pipe vises and wrenches and boiler tube expanders, will be sold at public auction on June 25, 1935, by the Industrial Plants Corp., auctioneers, 90 West Broadway, New York, N. Y.

• MEETINGS •

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Summer convention, June 24-28. Ithaca, N. Y. H. H. HENLINE, national secretary, 29 West 39th St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Summer meeting, June 19-21. Hotel Gibson, Cincinnati, Ohio. CLARENCE E. DAVIES, secretary, 29 West 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28. The Book-Cadillac Hotel, Detroit, Mich. C. L. WARWICK, secretary, 260 South Broad St., Philadelphia, Pa.

MACHINE TOOL SHOW. Sept. 11-21, Public Auditorium, Cleveland, Ohio. FRIDA F. SELBERT, secretary, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SILVER BAY CONFERENCE. Eighteenth annual conference on industrial relations, August 28-31. Silver Bay, Lake George, New York, N. Y. E. C. WORMAN, executive secretary, 347 Madison Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting, June 16-21. The Greenbrier, White Sulphur Springs, W. Va.

• PATENTS •

June 4, 1935

Metal-Working Machinery

Caliper Controlled Grinding Machine. Albert G. Belden, and Raymond A. Cole, Worcester, Mass., assigned to Norton Co. Patent 2,003,334.

Grinding Machine. Emil Ritz, Jr., Mount Healthy, Ohio, assigned to the Hisey-Wolf Machine Co. Patent 2,003,495.

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June 11, 1935

Metal-Working Machinery

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American Machinist

REFERENCE BOOK SHEET ©

Welding in Machinery Construction—II

A Tentative Code for Fusion Welding and Flame Cutting in Machinery Construction. Adopted by the American Welding Society, March, 1935

Section 7—Gas-Cutting

1. Gas-cut edges shall be smooth and regular in contour.

2. Gas-cutting may be used in the preparation of base metal parts for welding provided the edges so cut are left free from excessive scale.

3. Gas-cut edges at critical contours shall be ground or machined to eliminate notches. See Fig. 2.

4. Manufacturers of steel and of gas-cutting equipment should be consulted as to the proper preheating procedures when cutting special alloys and carbon steels with more than 0.30 per cent carbon.

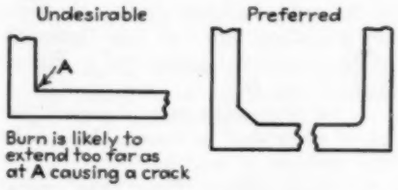


Fig. 2—Gas-cut edges at critical contours should be ground to eliminate notches.

Section 8—Qualification Tests for Operators of Welding Equipment

Each manufacturer shall be responsible for the quality of the welding done by his organization and, prior to the engagement of any operators upon the making of welds for the strength or safety of parts constructed under this Code, shall conduct tests of such operators to determine their ability to operate such manufacturer's equipment. Such tests shall require the making of a test plate weld in material the equivalent of that to be used in construction and in a thickness not less than the maximum to be used in construction except that the maximum thickness of such test plates need not exceed 1½ in. The dimensions of such test plates, the number and the type of the test specimens shall be as shown in Figs. 3, 4, 5 and 6.

Test Results

When using A.W.S. filler metal E-20 or G-20 the tensile strength shown by the reduced section tension test specimens shall not be less than 95 per cent of the minimum of the specified tensile range of the plate used. When using A.W.S. filler metal E-10 or G-10 the tensile strength shown by the re-

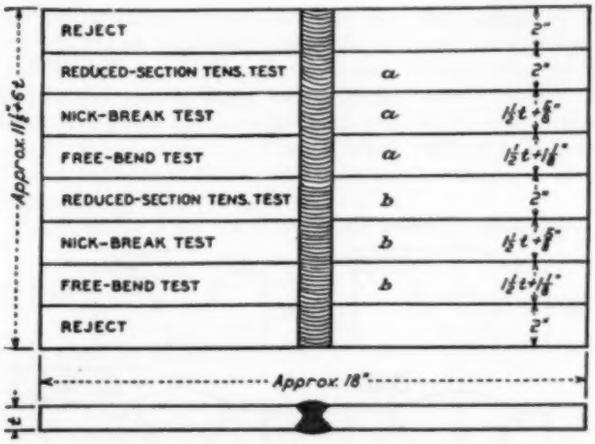


Fig. 3—Test plate dimensions and specimen locations

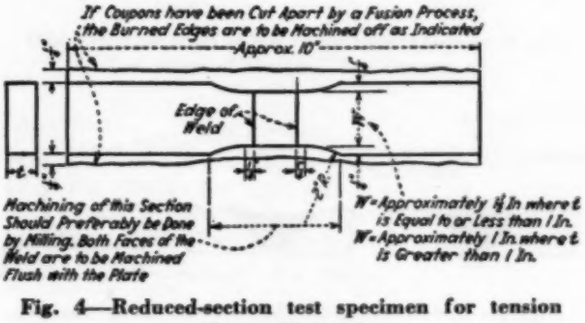

If Coupons have been Cut Apart by a Fusion Process, the Burned Edges are to be Machined off as Indicated
Approx. 10"
Edge of Weld
Machining of this Section Should Preferably be Done by Milling. Both Faces of the Weld are to be Machined Flush with the Plate
W=Approximately ½ In. where t is Equal to or Less than 1 In.
W=Approximately 1 In. where t is Greater than 1 In.

Fig. 4—Reduced-section test specimen for tension of a welded joint

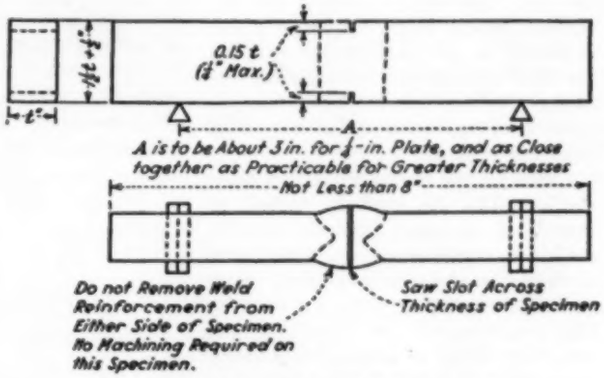

0.15 t (¾" Max.)
A is to be About 3 in. for ¾-in. Plate, and as Close together as Practicable for Greater Thicknesses
Not Less than 8"
Do not Remove Weld Reinforcement from Either Side of Specimen. No Machining Required on this Specimen.
Saw Slot Across Thickness of Specimen

Fig. 5—Specimen for nick-break test

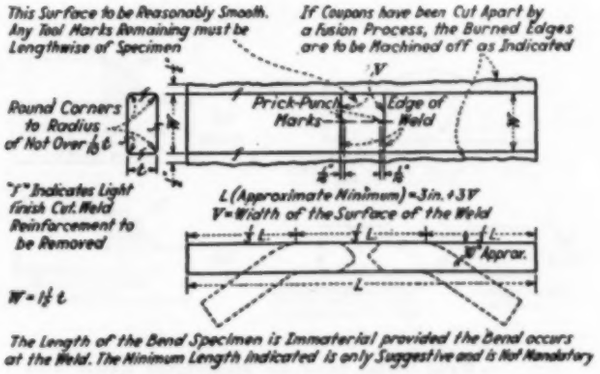

This Surface to be Reasonably Smooth. Any Tool Marks Remaining must be Lengthwise of Specimen
If Coupons have been Cut Apart by a Fusion Process, the Burned Edges are to be Machined off as Indicated
Round Corners to Radius of Not Over ⅛ t
Prick-Punch Marks
Edge of Weld
"f" Indicates Light Finish Cut. Weld Reinforcement to be Removed
L (Approximate Minimum) = 3 in. + 3V
V = Width of the Surface of the Weld
W = 1½ t
W Approx.
The Length of the Bend Specimen is Immaterial provided the Bend occurs at the Weld. The Minimum Length Indicated is only Suggestive and is Not Mandatory

Fig. 6—Specimen for free-bend test

Welding in Machinery Construction—II

duced-section, tension-test specimens shall not be less than the minimum of the specified tensile range of the plate used.

When using A.W.S. filler metal E-20 or G-20 the ductility requirements by the free-bend test method shall not be less than 20 per cent and when using A.W.S. filler metal E-10 or G-10 the ductility requirement by the free bend test method shall not be less than 30 per cent. In making the bend test for ductility, cracks at the corners of the specimen shall not be considered as a failure. The appearance of small defects in the convex surface shall not be considered as a failure if the greatest dimension does not exceed $\frac{1}{32}$ in.

When using either type of A.W.S. filler metal the nick-break test for soundness of the weld shall show in the fractured surface complete penetration through the entire thickness of the weld, absence of oxide or slag inclusions, and a degree of porosity not to exceed six gas pockets per sq.in. of the total area of the weld surface exposing the fracture, the maximum dimension of any such pocket not to be in excess of $\frac{1}{32}$ in.

Following the initial test of an operator's ability, he shall be tested, at periods of not more than six months, for his ability to produce a sound weld as shown by the nick-break test. Such test shall consist of making a weld by the same process for which he was originally tested in material of a thickness not less than the maximum on which he will be required to weld except that such material thickness need not exceed 1½ in.

The welding of all test plates shall follow the procedure to be used for construction. The process of welding, size and type of welding rod, number of welding layers, position in which the welding is done, etc., shall be the equivalent of that to be used for construction. Only such accessories or supplements of the welding procedure, for example, the employment of weld backing up strips or reheating of the test plate for stress relief or heat-treatment, shall be employed in the production of the test plates as will be required for construction. The test plates shall be so supported that warping due to welding shall not throw the finished test plates out of line by an angle of over 5 deg.

Section 9—Workmanship

1. *Soundness*—The weld metal shall be sound throughout and be free from excessive oxides, non-metallic inclusions and gas pockets. These conditions should be particularly avoided at the ends of the weld. The craters formed at the end of the weld shall be filled.

2. *Penetration* — The weld metal shall fuse into the root of the joint, as shown in Fig. 7, *A* and *C*.

3. *Fusion*—The weld metal shall be thoroughly fused with the base metal along all surfaces and edges of union. Multiple layer welds shall show no lamination or lack of fusion between beads. The weld metal along the toe of the weld shall not overlap the base metal surface, but shall fuse therewith as illustrated and contrasted in Fig. 8, *A*, *B*, *C* and *D*.

4. *Contour*—The natural surface finish of welds shall be reasonably smooth and uniform in contour.

5. *Undercutting*—The base metal along the toe of the weld shall not be reduced in thickness by the welding operation, as illustrated in Fig. 9, in the right-hand illustration.

6. *Tack welds*—Whenever tack-welds are used, inferior in quality to the designed welds, they shall be cut out before the final welding operation. Where they are of equal quality, they shall be thoroughly fused with the final weld.

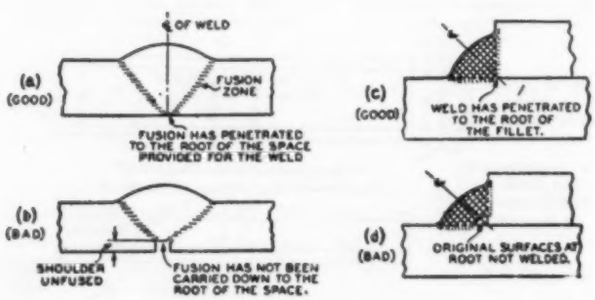


Fig. 7—Weld metal must be thoroughly fused with the base metal

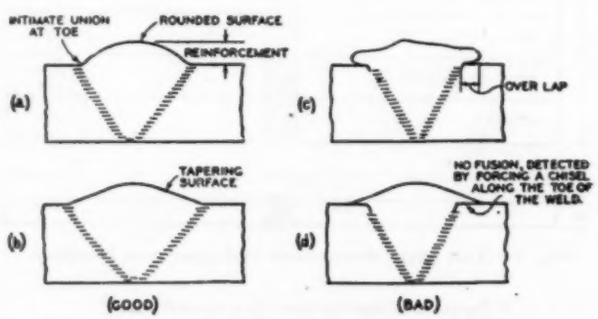


Fig. 8—Contour-surface of welds must be reasonably smooth and uniform in contour

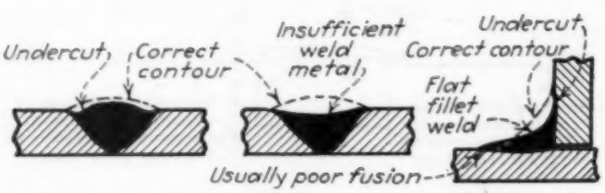


Fig. 9—Undercutting the base metal along the toe of the weld shall not be reduced

STENCILS

for Lighting Fixture Work

CHARLES WESLOW

MAKING lighting fixture stencils is a trade in itself, and before a toolmaker can expect to become successful in this art, he must first learn all about using a soldering iron on soft metals. While a soldering iron is a lifesaver in this work, a maker of such stencils must not lose too much time doctoring up mistakes. Soldering brass parts together is easy, but soldering cast tin is another story.

It is seldom that a regular toolmaker, or any other kind of mechanic, is hired for this work, unless he has had considerable experience, or is willing to go to work as an apprentice. A lighting fixture concern may advertise for a toolmaker on stencils, but nearly all applicants are rejected because they have had no experience in this particular line.

Stencils for lighting fixtures are made to cover the parts of the fixture that are to remain bright and to allow spray painting to be done through the openings. A simple job is seen in Fig. 1, which is a spun brass shell.

How It Is Done

A ½-in. hole is bored in the top of this shell so as to allow tin to flow through it, as will be seen later. The shell is then laid on a metal plate and molding sand is poured inside through the bored hole to about the height shown at *A*, Fig. 2. A fence *B*, made of sheet metal, is then put around the shell as shown. This fence is held by a soft iron or brass wire on the outside. The ends of the fence lap over so that melted tin will not leak through.. The fence is built high enough to allow a shank to be turned as in Fig. 3, with the work held in a lathe chuck. Molten tin is then poured around the shell, inside the fence, and flows through the center hole until it reaches the sand. The sand is then emptied out and the piece is trued up with an indicator. All the outside metal of cast tin is turned off, except what is needed to cover the parts that are not to be sprayed. The parts left in this case are shown in Fig. 4.

The shank is then cut off as in Fig. 5, which shows all that is left of the cast tin after the lathe work is done. The whole thing is then sawed in half with a hand hacksaw.

The halves are now joined with brass rods, as in Fig. 6. The rods are soldered at one end to a hinge *A* and brass straps are soldered as at *B* to hold both the handles as a single unit. A brass plate is soldered to one-half of the top section for covering up the solid end of the shell, and small brass plates as at *C* cover the openings left by the hack saw in cutting the shell in half. No screws are used in the construction of these stencils. Everything is soldered, assuring firmness.

The time required to make such a stencil varies from six to ten hours, depending on the number of tin covering bands that comprise the stencil. In the case shown, only two such bands are necessary.

Smaller parts can usually be sprayed using stencils that require only a spring clasp to hold them in place. The principle is the same but the making of such stencils requires less time.

A larger and more elaborate stencil job is shown in Fig. 7. This shows a cast iron part of a lighting fixture, and over it a cross-section of the stencil *A*. This stencil covers up everything except the stars shown. It leaves everything exposed on the flange except the

Fig. 1—A spun brass shell forms a simple example of stencil usage

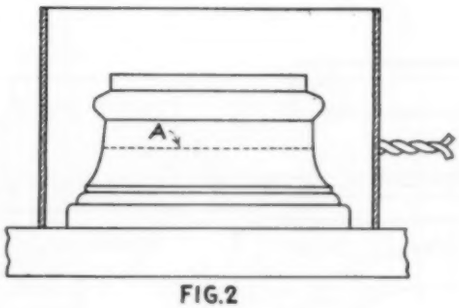


FIG.2

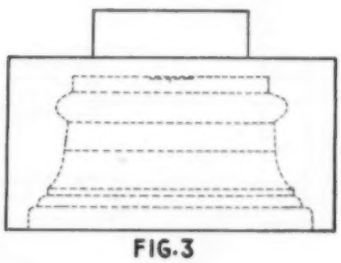


FIG.3

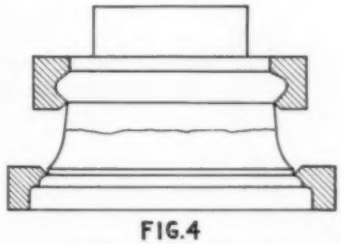


FIG.4

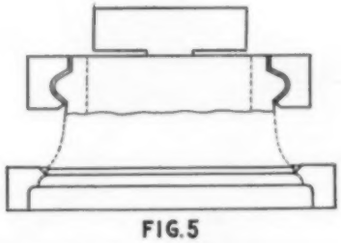


FIG.5

Figs. 2 to 5—Steps in the making of stencils for the piece shown in Fig. 1, including pouring the metal and turning it to shape

center bead which is covered by the ring *B*, made of cast tin.

The first operation is shown in Fig. 8. The modeler in another department places the domed casting on a board and builds a cardboard fence around it. Then he fills the space inside the fence with plaster-of-paris. When it hardens, he pares away the surplus plaster leaving about ¼ in. in thickness, and then cuts out the stars. It is then ready for the foundry where a tin casting is made, as shown in the cross-section in Fig. 9. This shows it as it appears on top of the cast iron part ready for the toolroom. Fig. 10 shows the stencil ready for use.

Brackets Hold the Ring

It is interesting to note how the frail circular wire shaped stencil part is held onto the main body of the stencil by means of brackets, and it must be remembered that this ring is of cast tin. These brackets are made of ⅛-in. round soft brass wire and are curved outward so as to permit free access of the spraying liquid to the flange which must be covered. The ends of these wire brackets are bent at right angles to make them easier to solder in place. The stencils are set over the work which rests on top of a revolving table something like a phonograph. The table is turned slowly by a small electric motor underneath the spraying outfit.

When the stencil comes from the foundry, it is not a goot fit around the stars. All that work must be taken care of by the stencil maker. With a soldering iron he adds more metal, and with a soft metal file, he removes any surplus until finally, only the complete stars show through. Such castings usually have a mark molded on them so as to make it easy for the sprayer to set the stencil in the proper position.

A considerable number of brackets are used to hold the bead covering ring secure to the body of the stencil. This is because the ring is made of cast tin and is quite frail. Tin is generally used except in small stencil parts; then a harder alloy is used, as otherwise it is too difficult to solder the brackets in place without melting the bead cover itself where the hot iron makes contact with it.

On some of the cast iron ornaments the stars have a raised bead around them which are not to be covered. In such cases it is necessary to provide a cover between the star and the bead as an extra unit, as is shown in Fig. 11. Such units are also cast in the foundry, and afterwards shaped out by the toolmaker with a file and soldering iron. They are then fastened to the main body of the stencil with brass wire brackets similar to those shown previously.

These stars are not all uniform in shape so that the covers must be fitted to each star separately and plainly marked. Some such stencils, after they have been used in spraying, look very much like a birthday cake, with all the brackets and stars sticking up like candles and bakery ornaments. The stencil here described is one of the simplest of its kind. Many are much more complicated and difficult.

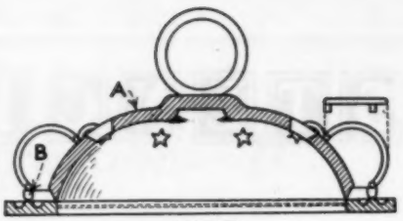


FIG.7

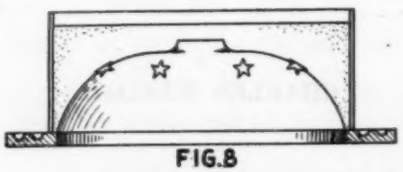


FIG.8

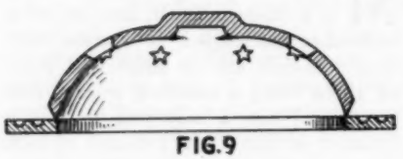


FIG.9

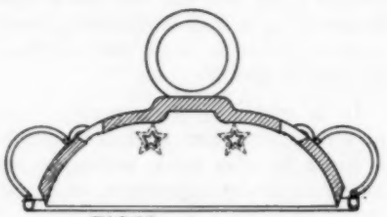


FIG.10

FIG.11

Figs. 7 to 11—The stencil for this fixture is more complicated but follows the same principle; note the ring for protecting the center bead

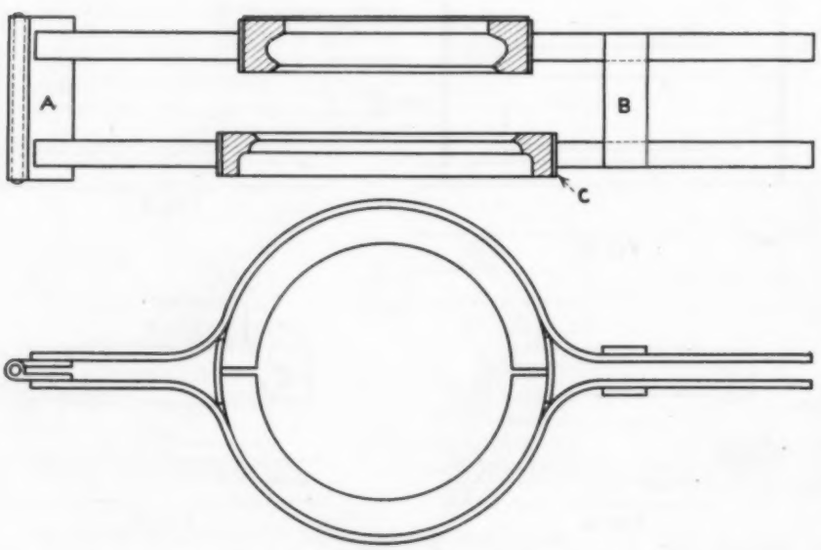


Fig. 6—Halves of the stencil are finally hinged together with brass straps

Slots Did It—Why? Discussion

CHARLES DOESCHER

In an article under the title given above (*AM*—Vol. 79, page 246), Frank C. Hudson is seeking information why four lengthwise slots in the bore of a bushing held it tight in a connecting rod, while a bushing without the slots always worked loose.

In my opinion the answer to the question is that the slots have, to a certain extent, weakened the bushing just enough to let it spring open slightly, particularly between the slots. When the bushing is driven into the connecting rod, it is held tightly by the press fit, plus the outward spring caused by the slots.

IDEAS

FROM • PRACTICAL • MEN

Time Saving Vise for the Drill Press

J. C. GLENN AND M. W. SEAVEY

The vise illustrated in Fig. 1 was developed to take the place of parallels and clamps in drill press work. It consists of a stationary and a sliding jaw, two parallel rods, a central screw and a thumbnut for adjusting the sliding jaw. One of the parallel rods is graduated in quarter inches for convenience in opening the vise a predetermined amount.

The stationary jaw has a rectangular groove at *A* and the sliding jaw has a flat at *B* both of which are for accommodating clamps for holding the vise in place on the drill press table. Both jaws have vertical and horizontal V-grooves in their inner faces and the sliding jaw has a V-groove in the top at *C*. The small V-grooves *D* are for a toolmaker's clamp for holding round work in the V-groove in the top of the sliding jaw, as indicated in Fig. 2. Steps in the inner faces of both jaws at *F* are provided for holding die-blocks and other flat work, as shown in Fig. 3. The vise can also be used as a base for a dial indicator, as shown in Fig. 4. The indicator is mounted on a rod that is held in one of the vertical V-grooves in the jaw.

As accessories, V-plates, as shown at the left in Fig. 5, are provided for both jaws. They have three slots at the bottom, the outer ones permitting the plates to straddle the parallel rods, on which they rest when in place. The center slot is for clearing the screw. One of the uses for the V-plates is indicated at the right, where a bushing is being held for drilling the oil holes.

A convenient accessory is a toolmaker's vise mounted as shown in Fig. 6. It has a stem in the base terminating in a 1¾-in. steel ball, the ball being held in the clamp block to be seen in the vise below. Work held in the toolmaker's vise can be presented to the drill at any angle within range of the mounting. A vise of this type, carefully made, and from mild steel machined all over, will be found entirely satisfactory for most all work within its capacity. In the same view are shown a pair of the V-plates referred to; a hold down clamp in place in the stationary jaw; and a toolmaker's clamp for holding round work in the V-groove in the top of the sliding jaw.

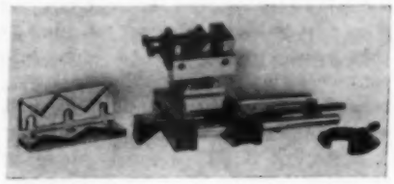


Fig. 6—The toolmaker's vise held in a universal mount in the jaws of the vise below. A ball on the end of a stem provides for universal adjustment

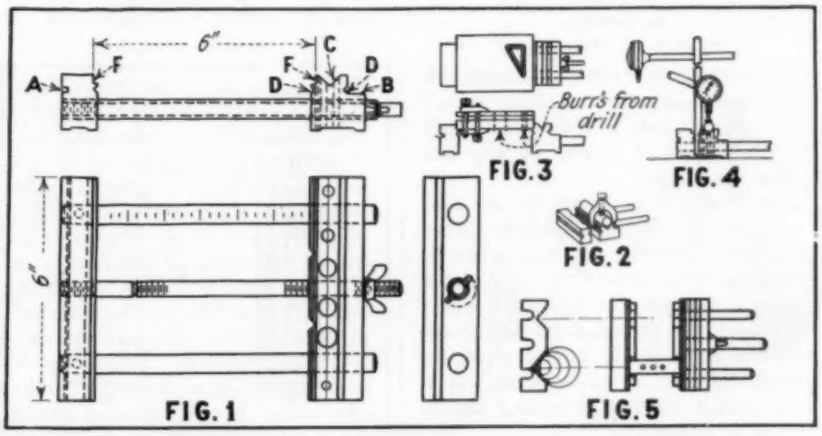


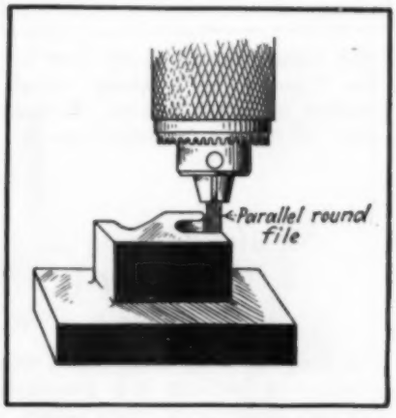
Fig. 1—The vise in detail. Fig. 2—Holding round work by a toolmaker's clamp. Fig. 3—Flat work held in the jaw steps. Fig. 4—The vise used as a base for a dial indicator. Fig. 5—The V-plates and one of their uses

Drill Press as a Filing Machine

ARTHUR OUTWATER

A piece of a parallel round file held in a drill chuck in the drill press, as illustrated, makes an excellent combination for rotary filing. It saves time in finishing dies, punches, and profile gages either to layout lines or to templets. With a round file of the proper diameter, the average job can be finished in one setting.

Clearance angles in dies can be provided for by tilting the table of the machine if it is of the tilting-table type, or by placing under the work a taper plate having the desired angle of taper. This method is very convenient in filing to the bases of punches. It keeps them parallel and makes a neat looking job. The fine horizontal lines left by the file can either be smoothed off before hardening or stoned off after hardening. Care must be taken not to get waves in the work by holding it too long or too hard in one place.



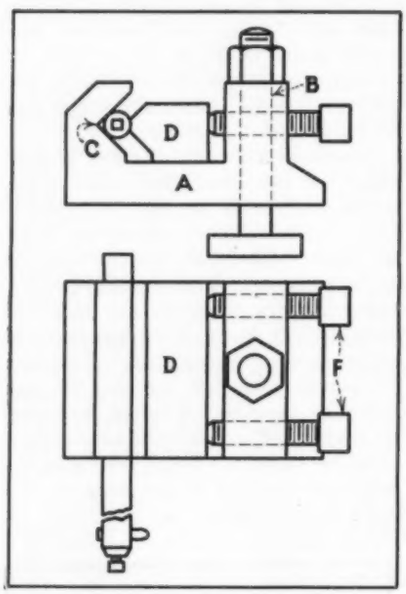
A drill press having a piece of a parallel round file held in a drill chuck converts the machine into an excellent rotary die filing machine

Boring Bar Holder for the Lathe

J. A. NIGHTINGALE

A device for holding boring bars in the lathe is shown in the illustration. The bottom of the cast-iron base *A* rests on the toolblock. A hole is drilled for the holding-down bolt *B* and a V-groove is machined at *C*, the apex being at the center height of the lathe. The boring bar is held in the V-groove by the block *D*, which is forced against it by the two screws *F*, the heads of which fit the toolpost wrench.

The advantages of this holder are that boring bars of various diameters can be used; that the boring bar is held more rigidly than in other types; and that in close quarters where the bar can not be removed by sliding it out of the holder endwise, it can be lifted out by removing the block that is between it and the screws.

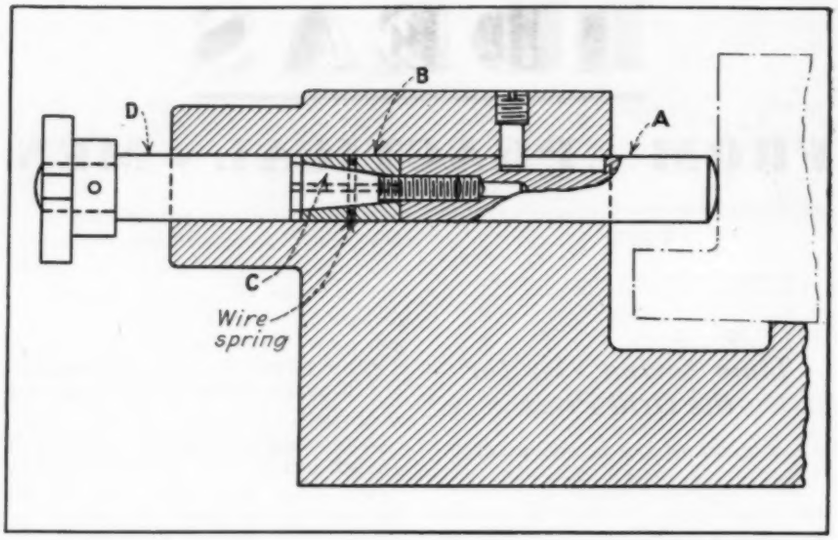


The boring bar is rigidly held in the V-groove by a block forced against it by two screws. Boring bars of various diameters can be used

Quick Acting Variable Stop

J. A. HONEGGER

In designing a fixture for a part with overhanging portions, it is sometimes necessary to locate or clamp against a surface further in than the projection. In addition it is also possible that the surface to be located may vary, especially if it is a cast surface.



To obtain quick operation of such a clamping device on one fixture the construction shown was developed.

A is the contact stop plunger, *B* is a split taper bushing, normally held against the taper *C* of the taper screw plug *D*, which plug is threaded into plunger *B*. Stop screw pin *E* limits the movement of plunger *B*.

In operation plug *D* is turned to the left to insure that the split bushing *B* is free to slide. A push on plug *D* then causes plunger *A* to come into contact with the work. Plug *D* is then turned to the right until bushing *B* is wedged tightly in the plunger hole.

A stop of this type can be designed to move rapidly over long distances. The length of the distance is only limited by the possible length of plug *D* and plunger *A*.

Self-Setting Countersink

H. MOORE
Hamilton, Ontario, Canada

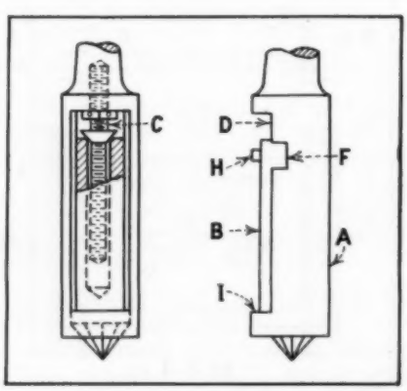
After the countersink illustrated has once been properly adjusted, it will countersink a hole to the correct depth for the heads of screws of any size within its range.

The body *A* is bored for an easy sliding fit for the countersink *B;* drilled and tapped for the adjusting screw *C;* milled away at *D;* and the short slot *F* is cut. The countersink itself has a clearance hole drilled at the top to admit the body of the largest screw for which the tool is to be used. It is also drilled for the projecting pin *H*, which is driven in.

When the tool is to be initially set, the countersink is turned to disengage the pin *H* from the slot *F* and is dropped down until the pin contacts the ledge at *I*, when a screw, of the size for which the hole is to be countersunk, is dropped into the hole at the top. The countersink is then raised and turned until the pin *H* engages the slot *F*. The screw *C* is so adjusted as to contact with the head of the screw in the top of the countersink when the hole has been countersunk to the correct depth, and the bottom of the body is in contact with the surface of the work.

Once this adjustment has been made, a hole can be countersunk for a screw of any size by putting a screw of that size in the hole at the top of the countersink. It will thus be seen that the head of a screw dropped into the hole in the top of the countersink gages the depth of countersinking for a screw of that size, and that after the countersink has once been set, there is no need to change the adjustment for screws of any size within range of the tool.

Such a tool will save a lot of time where flat headed screws are used.



Correctly adjusted, it will countersink a hole to the depth required for the head of any screw that is dropped into the hole at the top

Back Facing Attachment

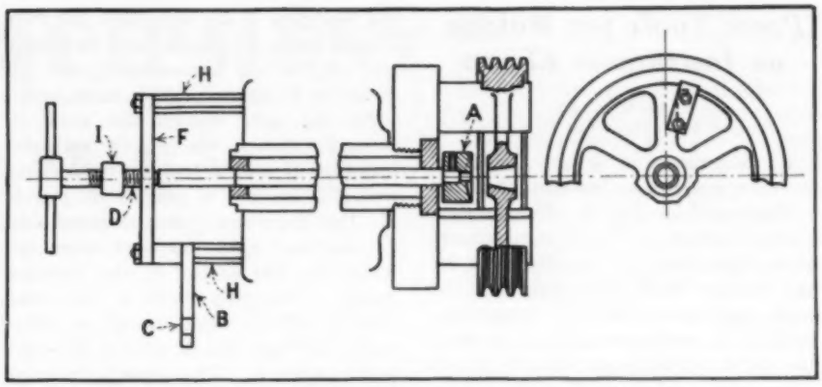
CHARLES C. TOMNEY
Chief Tool Designer
Carrier Engineering Corporation

Having to make a large quantity of multi-grooved pulleys, we naturally wanted to finish them at one chucking. Since the pulleys were chucked from the inside of the rims, all the work, except back facing the inner ends of the hubs, could be done at the same chucking. To eliminate the necessity of re-chucking the work for this small operation, we made the attachment illustrated for use on one of our Potter & Johnston automatic chucking lathes.

The back facing cutter *A* is mounted on the end of an arbor that passes through the hole in the spindle and is guided by bushings, one in the chuck and the other in the rear end of the spindle. The rear end of the arbor is square and the arbor is prevented from revolving under pressure of the cut by swinging over the pivoted latch *B* so that its square notch *C* engages the square on the arbor.

The cutter is fed to the work by the screw *D* pushing the arbor forward, the screw engaging in a tapped hole in the strap *F*, which is attached to the rear of the headstock by the long studs *H*. The feed screw is operated by a cross handle at its rear end and the position of the stop collar *I* on the screw controls the depth of cut.

After the rear end of the hub has been faced, the feed screw is backed off, the latch is swung out of engagement with the square on the arbor, and the arbor is drawn back by hand.



By the use of this attachment the inner end of the pulley hub is back faced without the necessity of re-chucking the work and performing an additional operation

Cutting Small Worm-Wheels

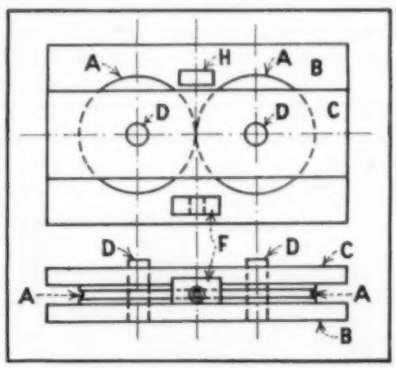
WILLIAM F. HULL

Satisfactory worm-wheels for model making or for experimental purposes, can be made as shown herewith.

Choose an Acme tap of suitable size, to correspond with the Acme bolt to be used for the worm. Calculate the diameter of the wheel required to give the desired reduction. The worm-wheel blanks *A* are turned with a half-round groove of a diameter equal to the diameter of tap at the bottom of the thread.

The jig can be made easily from any suitable material available; two pieces of strap iron serve well. The two pieces *B* and *C* are clamped together, and holes *D* drilled, with a center to center distance equal to diameter of the worm-wheel blanks. Drive drill rods into these holes in *B* to carry the blanks. Piece *F* has a hole drilled in it with a diameter equal to, or a little greater than outside diameter of tap. This is used only to guide the tap. Piece *H* is hardened steel. Strap *C* is merely to hold the blanks *A* flat, and must not prevent them from rotating. The center line of hole in *F* must coincide with the common center line of the grooves in the blanks.

To cut the wheel, insert the tap through *F* and screw into the blanks along their common tangent. When the tap strikes *H*, its longitudinal notion is stopped, thus causing the blanks to rotate and the teeth are cut around the outside of each wheel.

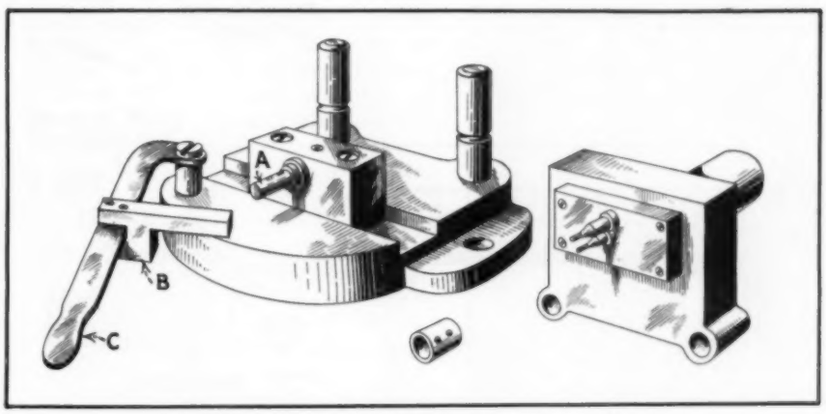


Piercing Core Irons for Meters

CHARLES H. WILLEY

In the construction of our moving-coil type d'Arsonval electric meters, we use a hollow core of Bessemer steel $\frac{21}{64}$ in. in diameter and drilled axially $\frac{11}{32}$ in., leaving a wall thickness of $\frac{1}{16}$ in. The cores are made from solid stock in a turret lathe and are $\frac{3}{8}$ in. long. Two 0.062-in. holes are pierced in them by the tools illustrated.

The tools are mounted on a self-aligning die-set and the punches are as short as possible, the front punch being $\frac{1}{16}$ in. longer than the rear one, so that one hole is pierced before the other. The horn die *A* is long enough to be supported by the block *B* which is swung under it by the lever *C* before the press is tripped. These tools have pierced more than 10,000 holes.



The core iron is placed on the horn die which is supported by a block swung under it by a lever before the press is tripped

Press Tools for Making an Instrument Clamp

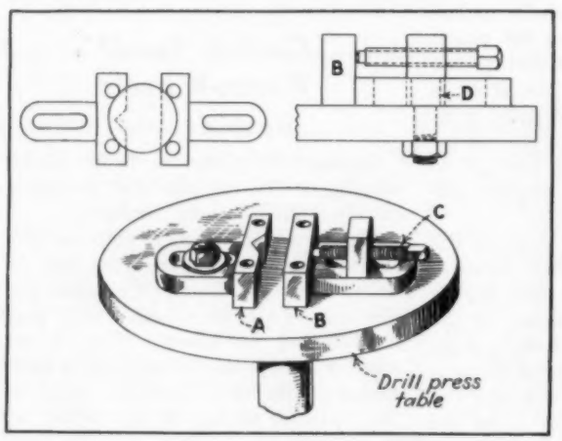
C. W. HINMAN
Scripto Manufacturing Company

A diagrammatic design for press tools for making an instrument clamp is illustrated in Fig. 1. The finished clamp is shown in Fig. 2, in which are given the necessary specifications for the work. While the design of the tools approaches that for progressive tools to be used in a multi-slide press, the job was run in an ordinary punch press.

The work is positioned in the tools with its cross-section at a right angle to the line of feed. This was necessary because the developed length of the blank was only ⅛ in. longer than the finished piece. Therefore, in forming and bending the work, the "draw in" was only $\frac{1}{32}$ in. on each side, so that the introduction of a severing punch in such close quarters was obviously impracticable.

Due to the 30-deg. bend in the work, the angle of which must be cleared by the strip stock on the forming and bending block *A*, it became necessary to run the strip stock *B* $\frac{1}{32}$ in. above the surface of the die-block *C*. This was accomplished by the use of the four spring-actuated pins *D*. When the ram descends and the cutting punches contact the strip stock, the four pins *D* are depressed, the two No. 23 holes are pierced and two slots are cut, having a connecting web of metal at *F*, between their inner ends.

At the next station the work is formed between the punch and die members *H* and *A* and the connecting web *F* is severed at point *I* by punch *K*. Two depressed spring-actuated pins *L*, raise and eject the work when released by the ascent of the forming punch. The strip stock is fed from right to left by hand, though an automatic roll feed can be used if the output justifies it. The press is inclined and the finished work is blown off the die by an air jet.



This device attached to the table of a small drill press has a wide range of usefulness and is a convenient accessory for the jobbing shop or the toolroom

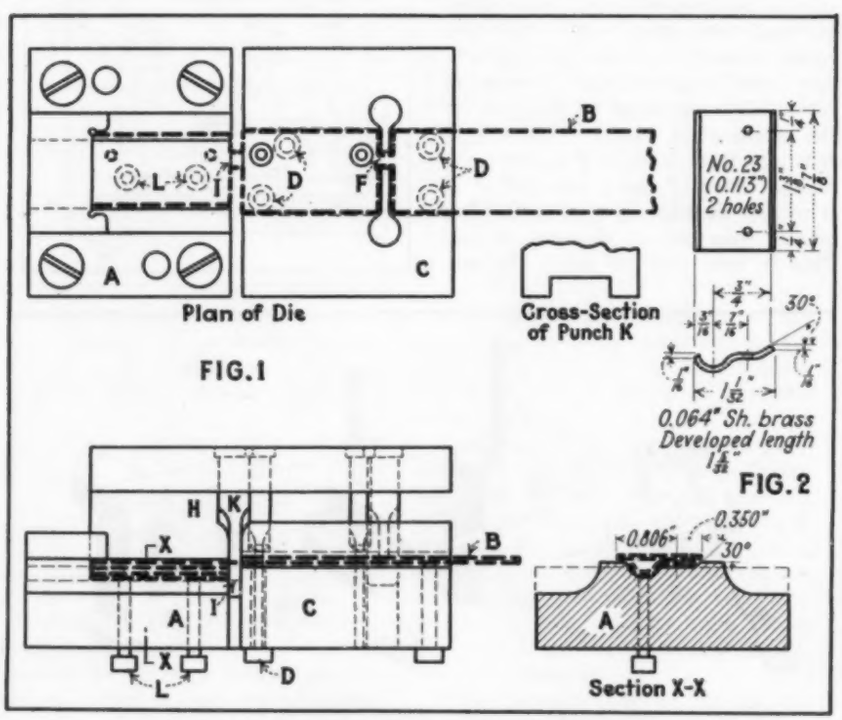


FIG. 1

FIG. 2

While the tool design approaches that for progressive tools to be used in a multi-slide press, the job was run in an ordinary punch press

Lathe Chuck for Holding Work in the Drill Press

PETER L. BUDWITZ

The article by Malcolm K. Parkhurst under the title given above (*AM*—Vol. 78, page 883), reminds me of a work-holding device that we use on some of our small drill presses.

Referring to the illustration, while the stationary jaw *A* is rigidly held in position by a capscrew, the slot in its extended base permits it to be adjusted by loosening the screw. The movable jaw *B* is tightened on the work by the screw *C*. The nut for this screw is integral with a shouldered stud passing through a slot in the extended base of the jaw and through the table, being secured by a nut on its threaded end. Part *D* of the stud is long enough to permit the base of the jaw to slide under the nut when the stud is tightened in the table.

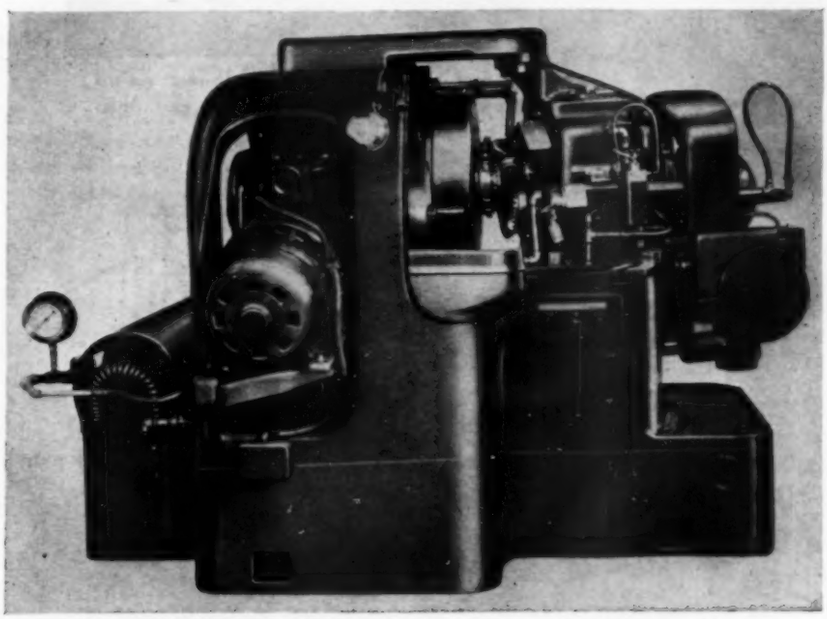
The stationary jaw has a vertical V-groove in its center for holding round work. Pins fitting in holes in the tops of both jaws permit disks to be held for drilling, as shown in the upper left-hand corner of the illustration. Since the jaws can be swiveled, taper work can be held.

New Enamel

Now it is a new enameling process and another coined word—Hommelaya. It is so opaque that the usual first ground coat now used is unnecessary in the new process for which less material, less fuel and labor in firing, greater output per furnace, less cracking or crazing and a smaller percentage of rejects are claimed. This is a result of research of the Mellon Institute at the University of Pittsburgh.

SHOP EQUIPMENT NEWS

Gleason No. 11 Gear Finishing Machine



One revolution of the cutter on the No. 11 gear finishing machine finishes one tooth, each blade removing a thin thread-like chip

The method employed by the No. 11 single-cycle gear-finishing machine, offered by the Gleason Works, 1000 University Ave., Rochester, N. Y., is said to be the fastest yet devised for finish-cutting spiral-bevel and hypoid ring gears. The gear to be finish-cut is previously rough-cut in the standard Gleason roughers, and then transferred to the No. 11 machine for finish-cutting. The face-mill finishing cutters consist of two series of inserted blades. First, a series of blades of progressively increasing depth shape and space the tooth by a succession of very light cuts. Then follow a series of finishing blades, each cutting the full depth, which finally size the whole profile of the tooth, and produce the desired smooth finish. The cutter and gear remain in normal full-depth operating position during the entire machine cycle, and provision is made for indexing by a gap in the cutter which follows after the second series of blades. When this gap comes abreast of the blank, the blank is indexed.

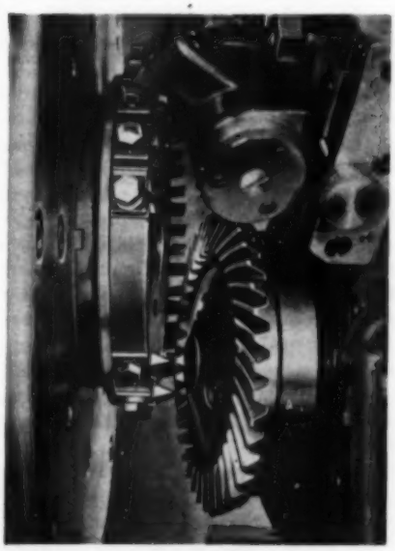
The cutter rotates at a uniform speed. When the cutter revolutions equal the number of teeth in the gear, the gear is finished. Very light finishing cuts prolong the blade life of the cutter. A hardened and ground precision index plate, mounted directly on the work spindle, is employed to insure accurate tooth spacing.

Chucking and dechucking operations have been facilitated by means of a power chucking and stripping mechanism, built into the work-spindle and controlled by a conveniently located lever. Fatiguing manual operations have been eliminated, and the time required to replace a finished gear with a rough-cut blank has been reduced. The control lever produces the following operations in order: clamps the gear to the arbor, advances the work-head to the cutting position and clamps the work-head.

An overhead tie connects the work-head supporting unit to the cutter column. Automatic features are fully protected by safety devices. An automatic stop, when the last tooth is cut, eliminates any possibility of re-cutting. The stop resets itself after each gear is completed.

A hydraulic unit, carrying 600 lb. per sq.in. pressure, supplies power for the hydraulic functions. This unit is driven by a separate 2 hp., 1,200 r.p.m. motor, and delivers sufficient power to operate more than one machine. The coolant supply pump is driven by a separate motor, ¾ hp., 1,200 r.p.m. Power for the cutter is supplied by a 3 hp., 1,200 r.p.m. motor, which is mounted on a support integral with the cutter spindle housing and is clamped to the main frame for additional rigidity. Lubrication of the machine is entirely automatic, and conveniently located sight-glasses permit checking of the system.

The advantages of this machine and method are said to be as follows: single revolution of the cutter to cut one tooth, no lost time while indexing, slow turning cutter spindle is the only moving part in operation during cutting and very light cuts are taken by each cutter blade.



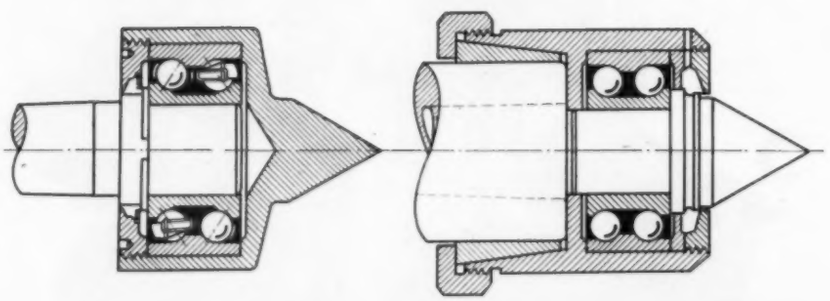
Close-up showing the rotary cutter with blades of progressively increasing depths

Elimination of a makeshift tooth-rest set-up simplifies the grinding of left-hand end mills

Cincinnati Improved No. 2 Cutter and Tool Sharpening Machine

The No. 2 plain and universal cutter and tool sharpening machine, built by the Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati, Ohio, has been improved by the adoption of a solid and heavier table slide, and by the addition of duplicate operating controls on the left side of the machine when facing the machine from the rear. This heavier table slide reduces vibration when grinding large rotary cutters. It also permits heavy loading when the table is displaced angularly, as in the grinding of dovetail milling cutters.

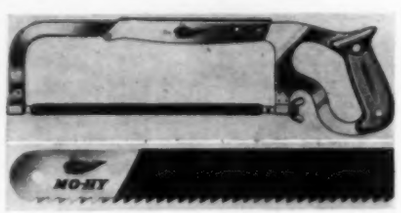
The addition of left-hand operating controls increases the adaptability of the machine. Regardless of the type of work, this machine affords a normal operating position. The improved machine retains such features as correct location of the work and tooth rest with respect to the right approach to the grinding wheel, good visibility of the work and grinding wheel, accessibility to make changes in the set-up and to true the grinding wheel without leaving the operating position, and safety of operation. No control brings the operator's hands in dangerous proximity to the grinding wheel. The grinding of left-hand milling cutters and spiral reamers is best handled from the left side of the machine when facing it from the rear. Grinding of left-hand end-mills is simplified by elimination of a makeshift tooth-rest.



"Red-E" New Departure Ball-Bearing Centers

The "Red-E" New Departure ball-bearing center, which the Ready Tool Co., Bridgeport, Conn., has added to its line of high-speed centers incorporates New Departure double-row, angular-contact ball bearings. This pre-loaded bearing, in which the two rows of balls are opposed to each other under a predetermined load, overcomes end play. Another feature is the short overhang so that the work is brought close to the tailstock, lends additional rigidity to the set-up. A seal in the back eliminates any possibility of cutting compound or chips getting into the bearings or of lubricant coming out.

These centers are offered in two types, the outside-of-the-spindle type and shank type. In the former a threaded collar draws the center back to a solid bearing against the face of the quill and forces split tapered spring bushings forward and down tight against the outside of the spindle. It is readily taken off and put on in position with accurate alignment.



Whale Hacksaw Blades and Frames

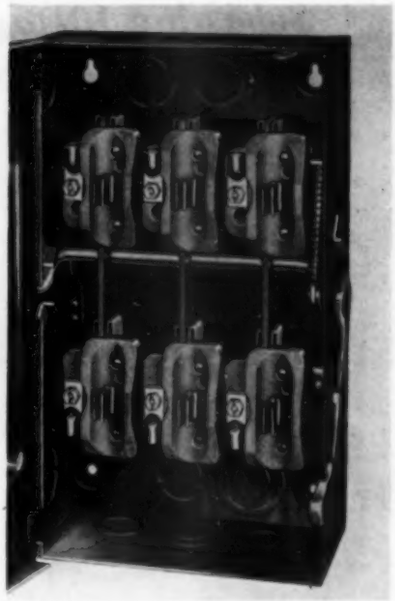
The Whale "Mo-Hy" hacksaw blades, added to its line by the Forsberg Mfg. Co., Bridgeport, Conn., are made of MoTung high-speed steel, a molybdenum steel. Although it is 9 per cent lighter than tungsten steel, it is slightly tougher, thereby resists breaking under strain. Hand blades are available in nine sizes, while heavy power blades are offered in 30 sizes.

The company has also announced an addition to its line of hacksaw frames. These heavy-duty, nickle-plated frames have "Lumarith" plastic handles screwed on both sides of the steel. Frames are adjustable for 8-to 12-in. blades. Weight is approximately 2 lb.

Colt-Noark Type "A" Industrial Switches

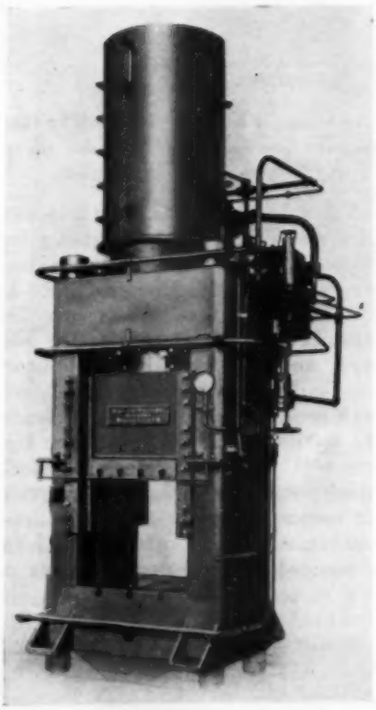
The Electrical Division of Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., presents a revision in its line of Type "A" industrial safety switches. The 575-volt Type "A" switches are equipped with the "Quad-Break" switching mechanism, which provides four current-rupture points in each leg of the circuit, thereby reducing the arcing tendency. Unit blocks have been redesigned for greater accessibility of contacts for cleaning and adjustment. A complete unit block can be removed from the cabinet without disturbing the rest of the switch. Line and load connections may be at either the top or the bottom.

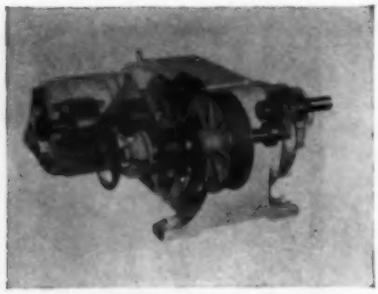
The 250-volt Type "A" switches make use of the "Dual-Break" switching mechanism which breaks the circuit at two points in each leg. The Type "A" cabinets have been made narrower and the new cast metal handles have been placed closer to the side of the cabinet.



Williams, White Hydraulic Straightening Press

The latest development in the line of heavy machinery built by Williams, White & Co., Moline, Ill., is a 750-ton straightening press for large malleable castings. This is a self-contained press of the rigid-frame type, with tie-rods shrunk in place, and the ram guided on the ram housing with adjustable gibs. The control of the ram is through treadle and hand lever, designed so that the press will make one complete cycle with the depression of the treadle, stopping in the up position. The stop position at the top of upstroke is adjustable. An adjustable time delay is furnished to change the length of dwell under high pressure before the automatic reversal of the ram. Rapid traverse of the slide to and from the work is accomplished by kicker cylinders, and an automatic surge valve fills the cylinder during the traverse stroke. The press is capable of twelve strokes per minute. Hydraulic pressure is furnished by an Oilgear rotary pump, with an unloading control which permits it to hold full volume until full predetermined and preset pressure is reached. This increases the speed of the press cycle. Speeds can be changed by adjustment of the volume control, and the tonnage by the adjustment of the pressure control, both operated from the floor.





U. S. Varidrive Motor

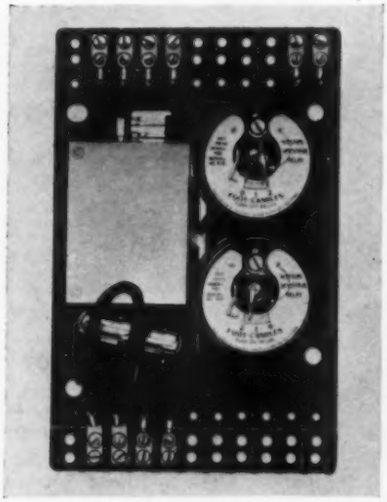
The U. S. Electrical Mfg. Co., Los Angeles, Calif., has developed a geared motor which offers a speed range from 1 to 10,000 r.p.m. without intricate control mechanisms. It is a self-contained unit and embodies an electromechanical power conversion which changes the fixed constant speed of the motor to variable speeds at the take-off shaft. Variations of 1, 10 or 100 revolutions or more are available.

The Varidrive consists of a squirrel-cage motor built integral with a variable-speed transmission. The latter comprises dual disks coupled with a "Varibelt." Speed changes are obtained by varying the effective diameter of the disks. A handwheel actuates a traveling hub which increases or diminishes the distance between the two sides of the driven disks. The motor element is comprised of a standard U. S. rotor with "AutoStart" principle and is asbestos-protected.

Ingersoll "Zee Lock" Side Milling Cutters

The "Zee Lock" cutter blade recently introduced by the Ingersoll Milling Machine Co., Rockford, Ill., has been applied to inserted-blade side-milling cutters. Securely retained in the cutter housing by the zee-shaped wedge, it is impossible for the blade to shift backwards or inwards away from the cut. The blade is adjustable in the proper proportional directions of wear. Cut thrust is absorbed by the serrations, not the locking member.

Half-side milling cutters incorporate the Zee Lock cutter blade. Plain side and interlocking cutters, with plain wedge locks, are also offered. Cutters are made as small as 4 in. in diameter by ½ in. wide. All Ingersoll Zee Lock cutter blades are of standardized dimensions so that when blades of corresponding thickness are worn in a larger cutter, they may be transferred to a smaller cutter.



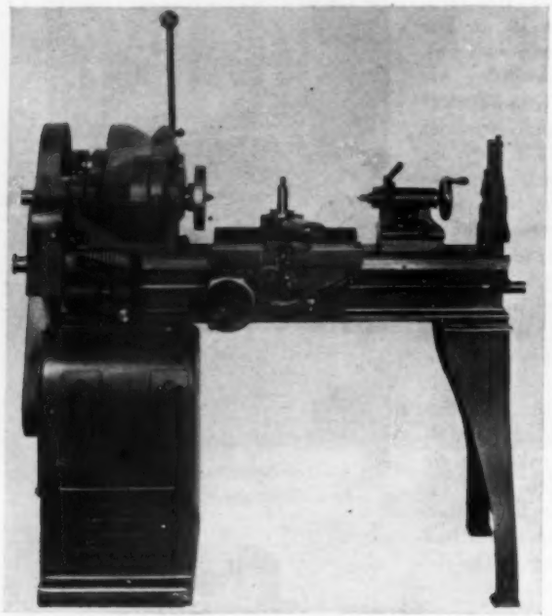
Weston Photronic Illumination Controller

A Photronic "electric-eye" control which turns lights on and off automatically to maintain a pre-determined level of adequate illumination has been announced by the Weston Electrical Instrument Co., Newark, N. J. The desired "turn-on" and "turn-off" illumination values are set in advance on two independent scales, and at these values the photronic cell actuates a relay controlling the light circuit to a mercury switch. The circuit is so designed that momentary shadows do not affect the automatic control. For indoor use, the light collection containing the "electric eye" is directed at the location where illumination is to be maintained, and the electric impulse it sets up is carried by ordinary leads to the panel containing the relay and switch. Both the light collector and panel are also available in weatherproof housing for outdoor use controlling yard lights, electric signs and a number of other special applications.

Rogers "Layout Fluid"

Dayton Rogers Mfg. Co., 1845 East Franklin Ave., Minneapolis, Minn., announces a "Layout Fluid" for preparing tool and die blank surfaces for layout. It has an advantage over the old copper sulphate method, because the scribed lines have a pronounced contrast against the dark background. With the use of the die blue layout fluid, the surface of the work need not be polished. It is merely wiped fairly clean and the fluid applied, drying immediately.

Sebastian 10- to 20-In. Cone-Head Motor-Driven Lathes



The motor is fitted underneath in the cabinet leg with one screw adjustment to take up play in the belt

The Sebastian Lathe Co., Cincinnati, Ohio, has placed on the market a line of cone-head motor-driven lathes, having swings ranging from 10 to 20 in. All sizes are of the same design. The tailstock of these lathes is of the solid type, and the lock of the tailstock spindle is a bush which not only serves as a lock for the spindle but locates the spindle, doing away with the keyway. A three-step cone headstock, which is single backgeared, provides six speeds through a 1¾ in. belt. A bracket at the rear of the lathe holds a cone which corresponds to that on the headstock. A safety interlock prevents both the screw and the length feed being thrown in at the same time. The apron is provided with a friction feed as well as a bevel-gear feed for longitudinal feeds. A safety shear pin is located on the main drive gear outside of the gearbox. An adjustable reverse plate is set so that when it is thrown from left- to right-hand threads and back, the depth of the teeth is adjusted so as not to permit the gears being thrown in too deeply.

Start, stop and reverse of the lathe are through a drum-type safety reversing switch mounted within easy reach of the operator. Lever adjustment keeps the cone belt tight. The operator cannot lift the guard over the cone belt without stopping the motor.

Specifications of lathe shown, swing 12¼ in.; length of bed, 4 ft.; distance between centers, 22½ in.; hole through the spindle, 1⅛ in.; swing over the carriage, 8⅜ in.; width of cross-slide, 4¼ in.; collet capacity, ⅞ in.; centers, Morse taper No. 3; thread range 3 to 96 per in.; and feed range, 0.008 to 0.252 in. per revolution.

This grinder weighs 15 oz.

"Hand-ee" DeLuxe Grinder

Through the use of new materials, the weight of the deluxe "Hand-ee" grinder, developed by the Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago, Ill., is only 15 oz., though the tool has a speed of 25,000 r.p.m., and ample power to drive a variety of different accessories. Alumilited duralumin is employed in the body of the tool while molded Bakelite parts are used as bearing retainers and for end caps. It is 6 in. in overall length and 1⅝ in. in diameter. The housing is streamlined with no obstructions of any kind. This is achieved through the use of an improved type of radial commutator and patented S-type built-in switch with sliding contacts.

Taylor-Winfield Automatic Resistance Heating Machine

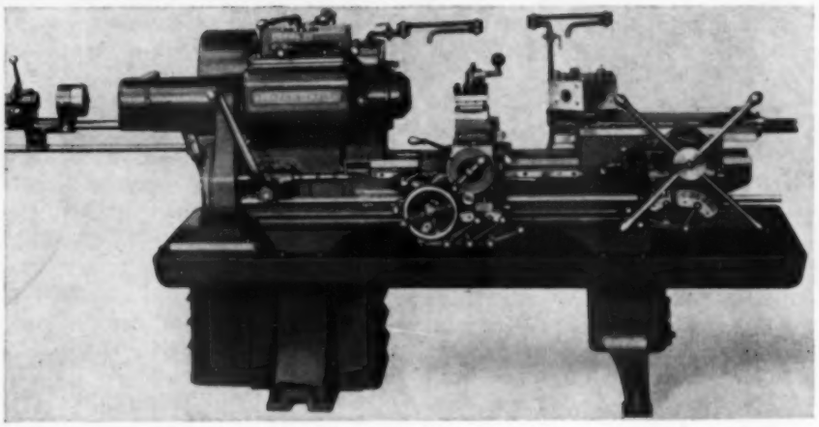
This machine was designed by the Taylor-Winfield Corp., Warren, Ohio, to heat tapered studs made from screw machine stock for subsequent hot forming in a press. Meeting a demand for 1,000 heated studs per hour, the actual current dwell for the heating of two pieces, simultaneously, is less than 3 sec. A 75 kva. transformer is used, mounted within the base.

In principle and construction the machine follows the general arrangement of Taylor-Winfield spot or projection welders. The base and other parts of the frame are made of welded sheet steel.

Except for feeding of the studs by hand into the indexing fixture, the operation of the machine is entirely automatic. The dial mechanism is operated by a small motor through a gear reduction, moving the dial from station to station at a speed convenient for loading. The upper electrodes are brought to bear on the studs by means of an air cylinder operated from the dial indexing mechanism. All movements are synchronized so that no attention from the operator is necessary. After the studs are heated to a predetermined temperature, they are ejected by an air cylinder into an inclined chute which carries them to the press for hot forming. Length of current dwell is governed by an electronic timer.

Similar equipment can be furnished for a number of heating operations, both large and small, and for practically any shape or material. The process is well adapted to the production heating of wire or slugs from which bolts are made, especially for metals not suitable for cold forming.

Electric resistance heater concentrates the heat where it is needed since the heat originates in the metal



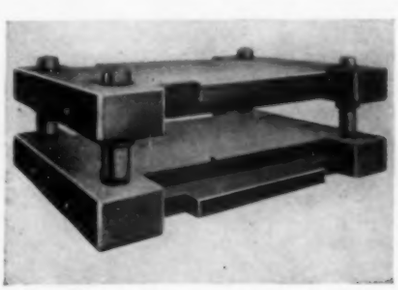
Universal cross slide carriage and hexagon turret operate independently and offer maximum opportunity for combined cuts

Danly Large Die Sets

To meet the needs of manufacturers requiring larger standard die-sets than those formerly available, Danly Machine Specialties, Inc., Chicago, Ill., has introduced a line of standard die-sets for heavy work. In the past, these large die-sets have usually been made special as a part of the die design. The types, sizes and thickness combinations of these large standard die-sets are the results of a survey conducted to determine what could be considered as standard in the large die-set field. Sizes of this line range from 10x18 in. to 46x100 in., available in all-steel or semi-steel.

Warner & Swasey No. 4 Turret Lathe

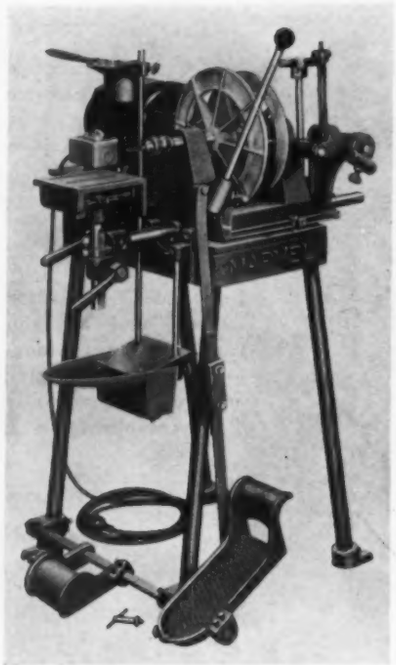
The No. 4 universal turret lathe announced by the Warner & Swasey Co., Cleveland, Ohio, has been developed to utilize to best advantage cemented tungsten carbide, in addition to high-speed steel cutting tools. It has twelve spindle speeds which range from 30 to 751 r.p.m., and a 7½-hp. motor may be used. Provision is also made for the application of a two-speed motor, giving an additional twelve speeds. A circumference binder ring automatically clamps the turret after indexing.



The travel of the turret slide is 12 in., with the power feed applied through a friction clutch.

A feature of the cross-slide is its large dial, so graduated that $\frac{1}{16}$ in. movement of its rim advances the slide 0.001 in. An automatic indexing square turret offers increased speed in manipulation. A plunger pump on the cross-slide lubricates both the slide and the bed ways. The gearbox is equipped with pick-off gears, making it possible to change the entire range of feeds provided by gears found in each apron.

The ratchet-type bar feed is designed for fast operation at high spindle speeds. Bar stock is held firmly concentric with the spindle bore by a revolving feed chuck. Direct spindle speed reading for the head levers allows rapid manipulation. Improvements have been made in the taper attachment, making it usable for all cross-slide tools mounted at front and rear positions.



Marvel Tapping Machine

The "Marvel" tapping machine introduced by the Armstrong-Blum Mfg. Co., 347 North Francisco Ave., Chicago, Ill., has a capacity range from fine thread No. 0 to ½ in. U.S.S. taps, in steel. The sliding table provides micrometer screw adjustment for depth and simplifies holding fixtures. The machine is made in both bench and floor types, all motor driven. Quick-change spindles are available for threading and tapping and nut or stud driving. The special two-tap geared spindle may be had for No. 0 to ¼ in. capacity. Models are available with spring-return sliding-table action, rear lever action with spring return, and front lever action with automatic depth trip and automatic reverse. The floor models are equipped with treadle action.

• TRADE • PUBLICATIONS

CLUTCHES. The Hanson Clutch & Machinery Co., Tiffin, Ohio, has issued a circular describing its Models A, B, D and F heavy-duty disk clutches. Line drawings show details of construction.

COMPARATORS. The comparator and measuring machine manufactured by the Jones & Lamson Machine Co., Springfield, Vt., for the optical measurement and inspection of a large variety of tools, gages and products, is described in detail in a recent publication of this company. Photographs and line drawings show details of construction and principle of operation.

COMPRESSORS. The Ingersoll-Rand Co., Phillipsburg, N. J., has published two well-illustrated catalogs, presenting its line of industrial compressors and vacuum pumps. The 32-page catalog, 7502-D, covers the company's line of "Type 30" Compressors, ¼ to 15 hp., pressures up to 1,000 lb. New features incorporated in the "Type XPV" steam driven, air or gas compressor are described in a 48-page catalog, No. 3344. Sectional views show details of construction.

COMPRESSORS. The Worthington Pump & Machinery Corp., Harrison, N. J., has issued a bulletin presenting its vertical single-stage air compressor, Type VS.

DROP FORGINGS. A leaflet, put out by the Kropp Forge Co., 5301 West Roosevelt Road, Chicago, Ill., presents its line of "Forgings to Your Specifications." The folder discusses the company's machining and heat-treating facilities.

ELECTRIC FURNACES. The Hevi Duty Electric Co., Milwaukee, Wis., has issued a folder, HD-535, describing its line of muffle furnaces for laboratory operations.

GEAR FINISHING MACHINE. The National Broach & Machine Co., Detroit, Mich., has issued a bulletin describing its "Red Ring" gear finishing machine and its operations. Specifications are given for three models.

IMPACT WRENCH. The Ingersoll-Rand Co., Phillipsburg, N. J., has issued a 16-page booklet, Form 2152-A, illustrating a wide variety of tasks for which the Pott Impact Wrench is being employed. This wrench can now be furnished with a reversible mechanism so that it can be used for both applying and removing nuts.

OIL SEALS. The Chicago Rawhide Mfg. Co., 1311 Elston Ave., Chicago, Ill., has published a bulletin on the application of oil seals

PORTABLE ELECTRIC TOOLS. The Black & Decker Mfg. Co., Towson, Md., has published its Silver Anniversary Catalog presenting its line of portable electric tools. The catalog contains 50 pages of illustrations and specifications of portable drills, screw drivers, nut runners, grinders and polishers.

PORTABLE ELECTRIC TOOLS. The James Clark, Jr., Electric Co., Louisville, Ky., has issued a loose-leaf folder containing bulletins covering many of their portable electric tools. From time to time, other bulletins will be added covering other tools in its line.

POWER TRANSMISSION. The Graton & Knight Co., Worcestor, Mass., has published a 44-page presentation of the subject of the application of power to the work. It contains a discussion of the proper application of both group and unit drives. Charts and tables that are useful in figuring the power transmission requirement of particular machines are included.

PUMPS. The Worthington Pump & Machinery Corp., Harrison, N. J., has published a folder describing its "Monoblock" centifugal pumps. Sectional views show details of construction, and ratings are given for three sizes.

SOCKET SCREWS. The Holo-Krome Screw Corp., Bristol, Conn., has issued a loose-leaf catalog explaining the method by which "Fibro-Forged" screws are made. Various applications are illustrated.

SOLVENT RECOVERY STILLS. The Barnstead Still & Sterilizer Co., Inc., 2 Lanesville Terrace, Forest Hills, Boston, Mass., has published a folder describing in detail its line of solvent recovery stills, which may be used for recovering solvents used in degreasing metal parts.

SPEED-LATHE. Circular No. 351 issued by the Schauer Machine Co., Cincinnati, Ohio, describes its complete line of "Ideal" speed lathes.

STEEL. "Steel Methods & Materials," published by Edgar T. Ward's sons Co., 400 Frelinghuysen Ave., Newark, N. J., is a handbook covering the company's line of steel products. Complete tabulated specifications are given for all items.

TOOL STEEL CHART. The Carpenter Steel Co., Reading, Pa., is offering to tool steel users in the United States, a wall chart, 30x20 in., to be used as a means for selecting the proper type of tool steel for all kinds of tools.

TUBING. The Summerill Tubing Co., Bridgeport, Pa., has published a 54-page catalog presenting its line of seamless tubing. The steel tubing produced by Summerill may be divided into two general classifications, namely, "mechanical tubing" and "pressure tubing." The catalog describes and gives specifications for a wide variety of tubing coming under these classifications.

THE ROUND TABLE

Five-Day Week

"What's this I hear about a five-day week, Al? Didn't know you favored it."

"I don't know yet whether I do or not. But the men wanted to try it."

"Who's boss of this shop anyhow, Al? I thought you were."

"I still think so, Ed. But there are times when it pays to let the other fellow try his hand."

"You may call that being boss, Al. I don't. Seems to me it's up to you to say what hours the shop runs. If the men don't like it they know what they can do."

"That's what the Czar thought, Ed. Kept on thinking it until he woke up dead one day. Of course this is a bit different, but it's something to think about just the same."

"I don't get you at all, Al. I suppose you'd double the wage rate if they asked for it."

"Now you are crazy, Ed. We're working 40 hours a week, spreading it over six days. The boys thought they'd like to have Saturday and Sunday to play—or work in the garden. So they asked why we couldn't work the 40 hours in five days. What's wrong with that?"

"It would have been fine if you'd proposed it, Al. Such changes ought to come from the top. Seems like you are letting the men run the shop."

"You better see a doctor, Ed. Something wrong with your digestion. I wish I had thought of it first, but I didn't. Perhaps it's just as well, though. It shows the men we are ready to accept any reasonable suggestion. I don't believe even you would be pig-headed enough to turn it down."

"Suppose you get a rush order?"

"Forty hours is 40 hours, Ed, whether you work six days or five. If we get a rush order the boys will help out as they always have."

"But, suppose they get to thinking they run the shop and won't work overtime?"

"Now you are getting off the track, Ed. We're not even proposing any change in the number of hours, or of wages. We'll just try working the whole 40 hours in 5 days. When it comes to overtime, that's another matter. Men who won't help us out in a pinch don't belong here."

"Just one more 'suppose,' Al, and I'll quit. What if they say they can't work 60 hours on any job?"

"Sixty hours is a long stretch, Ed. It's too long to ask in most cases. I might kick a bit myself. I'd try to hire more men before I'd ask that."

"I knew you were getting soft, Al. You'd better take something for it."

Will the shop turn out as much work in a five-day week? Is there any good basis for Ed's reluctance to accept a proposal from the men?

Discussion

Share the Wealth

If the same logic which is behind the discussion between Ed and Al were applied to our economic organization on a national scale we would then be in a frame of mind to begin solving our economic problems. As it is, there is no use to speak of recovery or a solution for the simple reason that we have not even started yet. We are still running around in circles, and to me it seems that about 99 per cent of the people are secretly hoping that by some hook or crook something will happen that will enable them to strike it rich and never have to work again.

As for myself, I am not interested in *isms* and I care not who owns this farm or that factory as long as we all work and apply ourselves efficiently, but I am getting sick and tired of seeing the few who produce the things actually essential to our welfare and happiness, supporting so many deadheads who obviously think that all that matterfs is to get the money; and equally as bad, the millions of unemployed who are on the dole. We cannot get something for nothing, and do what you may the load is going to fall on the producer. It is the producer who must share what he produces and contrary to popular notions, it is the producer and not the consumer who pays.

It is possible for us to see prosperous times again and much quicker than most people realize, but before we can even start we are going to have to get out of the rut with our way of thinking and change our method of approach. —RUPERT L. USREY.

Group Training

Group training on the basis suggested by Al and provided on a cooperative basis by a number of shops is all right if the percentage of benefit

each cooperating shop expects to gain is decided beforehand, so as to provide an equitable basis for dividing the expenses. Where a man is to be trained along special lines for a given shop, it should be understood in advance that his training expenses are to be entirely borne by the shop involved.

A system of this kind has the disadvantage that after a man has learned the ropes in school, he must to a large degree learn them again after he goes to work in the shop. But there is the advantage that the school is a splendid proving ground for the budding mechanic. If it becomes evident that he will not make a first-class workman, there has been no wasted time or actual interruptions on the production line because of him.

Where thoroughly competent instructors are in charge of the school, it can be made partly self-supporting by making models, doing experimental work, as well as odd jobs for outsiders.

—JOHN E. HYLER

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It appears that two of the usual channels for learning the machinist's trade, namely, the night school and regular shop employment, are practically closed. This leaves as a third and newer possibility, Al's suggestion for group training.

The greatest resistance to carrying out this plan would be in persuading local shops to cooperate in the distribution of supervision, teaching load, and the use of machines and supplies for instruction. Granting that the inertia of this innovation can be successfully overcome and that the idea of group training can be supported aggressively, the local shops should be able to look forward to a modest supply of reasonably-trained operators in the near future.

Likewise, men of the right fiber who are now on relief rolls would jump at such an opportunity to learn the groundwork of a trade and the prospect of ready employment with the upturn of business. —S. D. BRYDEN, JR.

One Man Shop

Yes, Al is right in continuing the business as a one-man shop. And one man can take care of 28 men, when he is well. A few days off will show only a little difference in production and the conduct of the men. Foremen are expensive luxuries. If Al should be taken down with a protracted illness, the shop could be shut for the time being.

Of course this assuming that it is to remain a one-man shop indefinitely. While Al is seeing to it that the men are producing he does not have time to bother about new designs. He will also be spared the annoyance of scanning the field and finding an outlet for increased production.

Shop foremen have a bad habit of assuming authority over routine details; they also pick up small difficulties and stop them at their source. Men would rather go to a fellow-worker or foreman for information than to run to the big boss.

With the cares of the shop taken from Al's shoulders he would have too much time on his hands, this would cause him to fall into the evil ways of finding new purchasers, improving the designs, increasing the force, employing more foremen, building an industry, and—destroying the one-man shop.

It is advisable to give a man limited authority and hold him responsible for results in a budding industry; but in a one-man shop he will always remain just an "as is," and go along with the boys. —W. E. FISCHER

What Is Productive Labor?

The term productive labor, if not originated by the socialists, was at least used by them to good advantage to support their case against the employers. The intention is to imply that direct labor alone produces, and that all other classes, foremen, employers, etc., are riding on the producers.

Those who are not socialists should leave the use of this expression alone, and instead should refer to direct labor and indirect labor. Direct labor being applied to the labor on the actual material that is to be sold subsequently, and indirect labor to labor that aids or expedites production in any other way.

—A. W. Forbes,
Forbes & Myers.

Tap Testing

Al's method of testing taps may seem like caution carried to excess when we consider the careful manner in which taps are made, but is it? We know that taps leave the factory correct in every detail within very close limits; modern inspection has seen to that. We also know that the manner in which the tap is used often determines the quality of thread it will produce.

The spindle speed of the tapping machine may be too high for the grade of metal being tapped. The tap will cut large because of the heat generated by undue friction and gradually go to the other extreme and cut small as friction causes it to wear. Often a few seconds spent in running a tap through a hole drilled in a piece of junk metal will save a lot of re-tapping on the assembly line, or having to have studs or screws made to fit holes that were tapped oversize. Al wanted those tapped holes to be right and he was willing to spend a little time to test the taps.

—Robert S. Alexander.

It may be said safely that no really satisfactory method of measuring a tap has been devised.

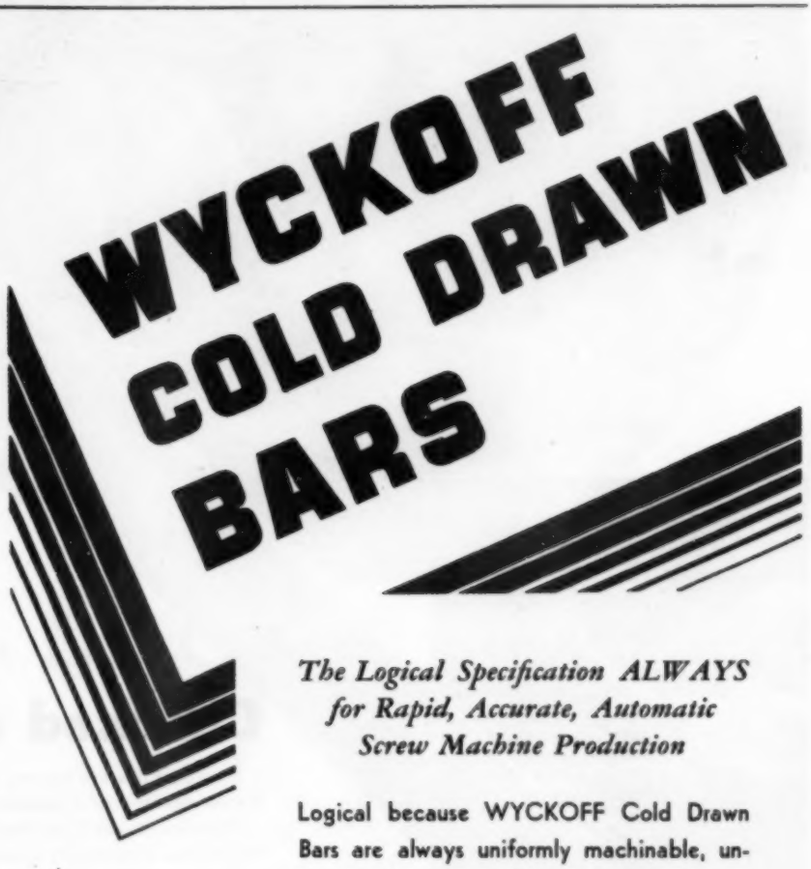
Some of the factors to be considered when gaging taps are over-all diameter, thread form (which itself includes many factors), pitch and straightness. Other factors, which have nothing to do with the size of the tap, are cutting rake, bluntness of the cutting edges and any tendency for the tap to carry the chips so that they cause wear of the newly cut thread.

Unskilled use is another indefinite factor as improper sides thrust on a tap may result in an oversized tapped hole. The cutting size of the tap drill must be kept constant, otherwise the profile at the small diameter of the tapped thread is varied, and it may just be this part of the thread on which the screw would fit.

Rigorous testing of the taps is not much use unless the screws which are to enter the holes are tested. The most common way of doing this is to check them by a standard screw ring gage.

Providing the screws are standard, tapping holes with the taps under working conditions and checking the holes with a standard plug screw gage is satisfactory as the fit of the gage is the fit of the screws, and all factors which are definite or indefinite are accounted for. This method is probably cheaper and quicker than subjecting each tap to a series of exacting measuring tests and ignoring those factors which cannot be measured.

—R. Hutcheson.



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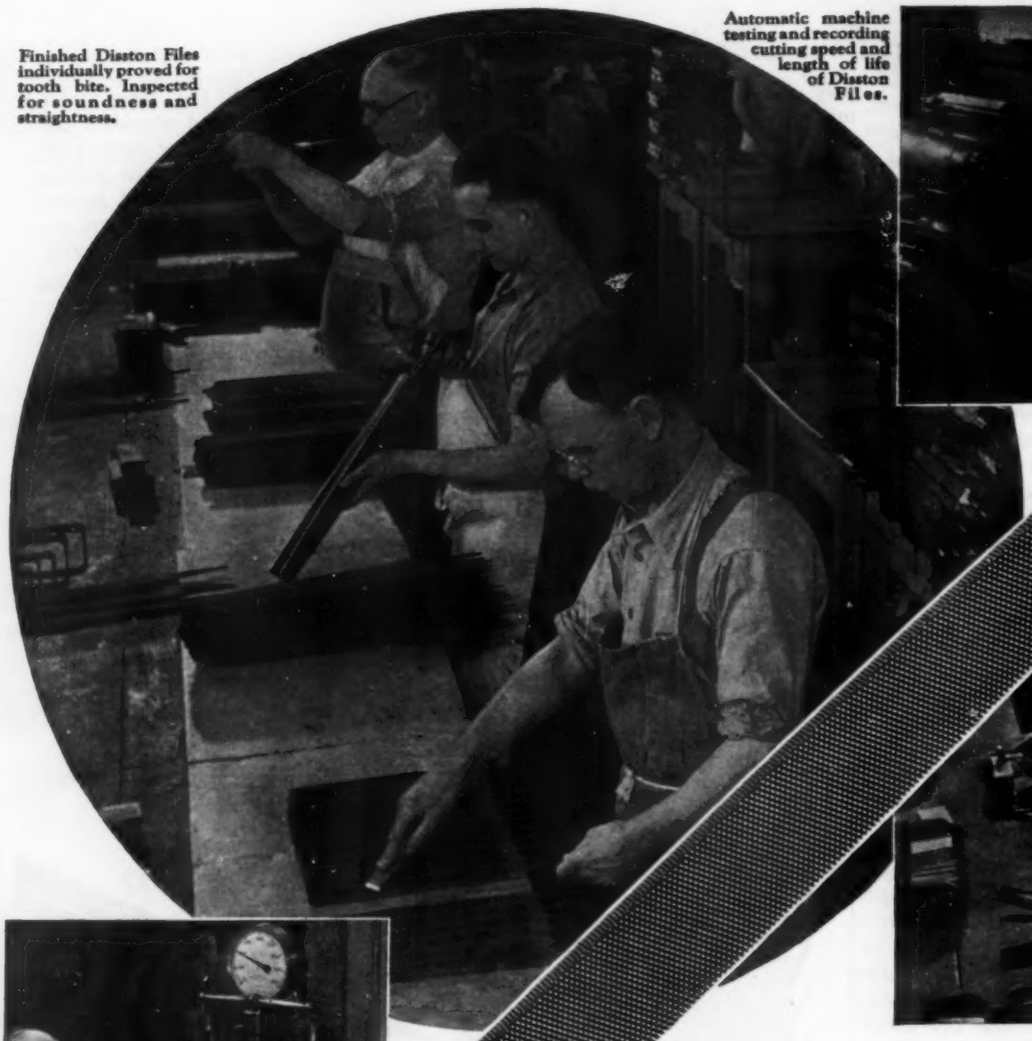

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